



Navigating Prototyping Spaces

Translation of knowledge and actors in Participatory Design

Pedersen, Signe

DOI (link to publication from Publisher):
[10.5278/vbn.phd.engsci.00134](https://doi.org/10.5278/vbn.phd.engsci.00134)

Publication date:
2016

Document Version
Publisher's PDF, also known as Version of record

[Link to publication from Aalborg University](#)

Citation for published version (APA):
Pedersen, S. (2016). *Navigating Prototyping Spaces: Translation of knowledge and actors in Participatory Design*. Aalborg Universitetsforlag. Ph.d.-serien for Det Teknisk-Naturvidenskabelige Fakultet, Aalborg Universitet <https://doi.org/10.5278/vbn.phd.engsci.00134>

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TRANSLATION OF KNOWLEDGE AND ACTORS
IN PARTICIPATORY DESIGN

by
Signe Pedersen
The Faculty of Engineering and Science



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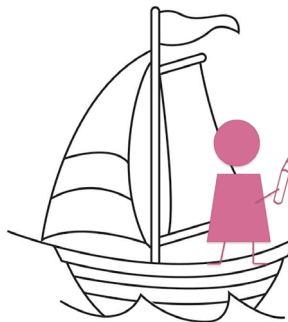
TRANSLATION OF KNOWLEDGE AND ACTORS IN PARTICIPATORY DESIGN

by

Signe Pedersen



AALBORG UNIVERSITY
DENMARK



Thesis submitted: 01.08.2016
PhD supervisor: Associate Prof. Hanne Lindegaard,
Aalborg University

PhD committee: Associate Professor Liz Sanders,
Ohio State University

Professor Thomas Binder,
Royal Academy of Fine Arts Schools of Architecture

Professor Susse Georg,
Aalborg University

PhD Series: Faculty of Engineering & Science,
Aalborg University

ISSN (online) – 2246-1248
ISBN (online) - 978-87-7112-770-6

Published by:
Aalborg University Press
Skjernvej 4A, 2nd floor
DK – 9220 Aalborg Ø
Phone: +45 99407140
aauf@forlag.aau.dk
forlag.aau.dk

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Printed in Denmark by Rosendahls, 2016

ENGLISH SUMMARY

This PhD dissertation has the format of a travel logbook inviting the reader to learn about my experiences and navigational moves during the exploratory journey being my PhD project. Motivated by a desire to investigate how knowledge is translated between designers and diverse actors in the process of designing products, services and systems in a healthcare setting, and to use this research for proposing operationalized strategies for navigation in participatory design projects, I made it my mission to:

1) Explore how knowledge is translated in participatory design practices in a business context, 2) develop an operationalized approach for design practitioners, 3) inform the scholarly discussions on Actor-Network Theory (ANT) and Participatory Design based on insights from case studies, and 4) inform the healthcare setting.

Using a multi-sited ethnographic approach inspired by ANT and Participatory Design I visit three islands; the PPI Island, the IO Island and the PSS Island, and engages with their populations to learn and gather empirical material. Being a design engineer myself, allowed me to engage in 'participant observation' to a varying degree in the three cases and thereby gaining valuable and detailed empirical material.

Building on Actor-network Theory, Participatory Design, Boundary Object theory and prototyping literature, I develop and introduce two sensitising devices 'navigation' and 'Prototyping Spaces' to draw attention towards navigational aspects in Participatory Design and propose operationalized strategies and concepts related to navigation. Focusing on the designers' ability to Navigate Prototyping Spaces points to special challenges within the healthcare sector where many important and diverse actors – not only end-users should be invited to participate in design processes. My research indicates that actors should not only be involved in testing a solution, but also in the initial negotiations about the nature of the object of design. During this process prototypes working as boundary objects serve as a central element for these negotiations due to their abilities to represent 'matters of concern'. Furthermore I advocate that it might be beneficial for design practitioners to see the object of design as a flexible network involving objects and actors, rather than focusing on only designing the objects.

DANSK RESUME

Denne ph.d.-afhandling har format som en rejse-logbog som inviterer læseren med på en rejse igennem mit PhD projekt. Motiveret af et ønske om at undersøge hvordan viden vandrer imellem forskellige aktører i en kompleks sundhedssektor samt at foreslå operationaliserede strategier og metoder for navigation i participatoriske design projekter, har jeg gjort det til min mission at:

1) Undersøge hvordan viden oversættes og vandrer i en participatorisk design praksis i erhvervsmæssig sammenhæng, 2) udvikle en operationaliseret tilgang for design praktikere, 3) informere de videnskabelige diskussioner omkring synergieffekter imellem Aktør-Netværks Teori (ANT) og Participatory Design (PD) baseret på indsigt fra casestudier, og 4) informere sundhedssektoren omkring design.

Ved hjælp af en multi-sited etnografisk tilgang inspireret af ANT og PD drager jeg på min rejse ud og besøger de tre øer; PPI øen, IO øen og PSS øen, for at interagere med lokalbefolkningerne som et led i mit empiriske arbejde. Min baggrund som design-ingeniør har gjort det muligt for mig at anvende "deltager observation" i varierende grad på de tre øer, og har som følge heraf givet mig detaljeret empirisk materiale.

Med udgangspunkt i ANT, PD, teori omkring Grænseobjekter samt prototype litteratur, udvikler og introducerer jeg de to koncepter 'navigation' og 'Prototyping Spaces' for at henlede opmærksomheden på navigationsaspekter i PD og foreslå operationaliserede strategier og begreber relateret til netop denne navigation. Fokus på designerens navigation af Prototyping Spaces peger på nogle særlige udfordringer inden for sundhedssektoren hvor mange forskellige aktører bør inddrages i design processen. Min forskning viser, hvordan disse aktører ikke blot bør involveres i de endelige tests af en løsning, men ligeledes i de indledende forhandlinger omkring designobjektet. I denne proces virker prototyper som grænseobjekter og står som et centralt element i disse forhandlinger grundet deres evne til at repræsentere et potentielt 'vedkommende anliggende'. Desuden advokerer jeg for, at det kan være gavnligt for design praktikere at se designobjektet som værende et fleksibelt netværk der involverer både objekter og aktører, snarere end udelukkende at fokusere på at designe objekterne.

ACKNOWLEDGEMENTS

First of all I would like to thank all the people who allowed me to follow their work and use these experiences as the foundation for my empirical material and analysis. A special thanks goes to Jens Ole Pedersen and Daisy van Minde from Philips Healthcare for inspiring conversations, interesting experiences and for allowing me to actively participate in, and contribute to, your efforts of developing new products and services to the healthcare sector!

Second, I owe so much to my team of 3 'cheerleaders' – my three supervisors. Even though I officially only have one supervisor, I feel so privileged to also have benefitted from the invaluable knowledge and support from Søs and Christian. Thank you Hanne, for being my main supervisor and for always being available for support and positive reinforcements. Thank you to my colleague, friend and travelling companion, Søs, for all your care, encouragement, laughs, interesting discussions and unconditional support during my entire PhD project. I also want to give a very special thanks to you, Christian, for challenging me and for using hours of your time on friendly and intellectually stimulating discussions and conversations. You have truly opened my eyes and given me an interest in theoretical aspects, that I would not have imagined possible when I started on this endeavour. Your knowledge, experience and patience have been truly invaluable.

I would like to thank my amazing colleagues and 'roommates' (current and past) at AAU for actually making it fun to go to work! You have all been true inspirations to me, and I feel privileged to have such intelligent and caring friends and colleagues! And lastly I also want to give a special thanks to my friends and family for your kindness, encouragements and support, and for actually trying to understand what I have been doing throughout the PhD project. I love you all.

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CHAPTER 1. MOTIVATION AND INTRODUCTION

INTRODUCTION

It was never in the cards that I would end up doing a PhD. When studying at the university I perceived PhD studies as something that only extremely smart, theoretically well-founded people, who also had a dream of being professors, did. I apologize for my prejudice, but I was both young and inexperienced at that time.

One of the reasons why I did not think that I was 'PhD-material', is because I am a very practically oriented person, and I love doing stuff where I can see a result – preferably a physical and tangible one – right away. My dad is a carpenter and when I was little, I proudly pointed to different buildings he had been part of constructing. Looking back, it was actually no surprise that I got enrolled in the engineering education Design and Innovation at the Technical University of Denmark. I was eager to design new products, and I was practically glowing sitting inside the 1:1 prototype of a refugee shelter I designed for the Danish company Vestergaard Frandsen for my Bachelor's Thesis. And it was a rewarding moment when we first tested the prototype of an improved cooking stove designed for the women in Nepal. Apart from being a daddy's girl, I am also greatly influenced by my caring mom, a social worker, who has always had a profound wish to understand and empathise with people's motivations and aspiration and uses this to help improve their quality of life. Even though I very much appreciate the structured and methodologically strong discipline of Engineering Design, surely my mother's influence made me intrigued by Participatory Design, seeing users as partners in the design process and having democracy and change at it's core. I learned that sharing knowledge and learning from each other was essential, but sometimes also rather difficult when designing together with actors from different fields than my own. This challenge became a pursuit in learning new things from many different people due to my curiosity.

Why am telling you my whole life story?? Because I am trying to give you an idea of how I was formed to think and approach the world, using my engineering background and interest in people as a motivation for creating new ideas and concepts – both academically and practically.

MY MOTIVATION

My motivation for doing this PhD stems from my years of experience as a design engineer. I have amongst other things designed refugee shelters, improved cooking stoves for healthy kitchen environments in Nepal and health promoting product service-systems for diabetes patients in India by involving many different actors in a participatory design process. Over the years, I noticed that my approach was quite different from other design project, but I was not quite able to put my finger on the differences. Companies and NGOs promoted their development work as ‘user-involvement’ or Participatory Design, but their actual process did not resonate with my understanding of user involvement in participatory design processes. Especially two elements distinguished my approach from the others. One is that instead of only inviting the end-users to participate in the design process, I involved many different actors from the entire value-chain already from the beginning of the project. And the other is that rather than only designing an object, I also designed the system of services to support this object. So instead of designing a stove, I found manufacturers, NGOs that would distribute the stoves, made arrangements with the government who were to subsidise the stove and designed Kitchen Management-courses for building capacity among the local Nepalese women. Looking back at my studies at DTU, I realised that perhaps the idea of Actor-Network Theory (ANT) had resonated more with me than I was initially aware of. I also understood, that even though I had practical experience conducting design projects, I did not quite have the language to communicate these experiences. So based on my ‘upbringing’ at DTU, I came to believe, that the combination of Participatory Design and ANT would give me a powerful and nuanced language to identify and communicate central aspects of staging and facilitation of complex design processes and to translate knowledge into useful products, services and systems.

To briefly introduce how Participatory Design and ANT go together, it is essential to look at design as formation of networks (Akrich et al., 2002). ANT might both provide a language to speak about network-building in design and at the same time qualify the participatory design process, while Participatory Design with its operationalized methods might enable ANT to be applied prospectively. Other scholars have engaged in this dialogue (see e.g. Latour 2008; Linde 2012; Storni 2015; Storni et al. 2012, 2015), and my goal is to contribute to this dialogue based on my past experiences as a designer, a number of case studies during this PhD thesis, and theoret-

ical knowledge on Participatory Design and ANT. With inspiration from these two theoretical and methodological traditions, I will come to develop and promote two sensitising devices: Navigation and Prototyping Spaces, for analysing my empirical material and suggest an operationalized participatory design approach.

Inspired by the idea of navigation in design, my telling 'grip' for illustrating how theory and practice are interlinked is to use the metaphor of 'design as an exploratory journey' to write this summary. Many authors before me have used this metaphor, perhaps because it provides a framework for talking about processes and movement that I also find very useful. Another reason for using this particular metaphor is that during this PhD-process, I have had many conversations with various people about how designers needs to navigate the participatory design process to eventually come up with a sound solution. He or she continuously has to make navigational decisions in response to the circumstances they encounter such as contradictory opinions, and certain rules and regulations, which needs compliance. And the same thing applies when doing a PhD.

A JOURNEY WITH ME AS NAVIGATOR

So I invite you to come with me on a journey of my PhD project. This dissertation is structured as a sort of travel log taking you with me on my exploratory trip through dangerous waters, in horrifying encounters with sea monsters and in the exploration of beautiful and colourful exotic islands with interesting populations and typology.

NAVIGATION

A designer can be seen as the navigator on an exploratory journey of a design process, in charge of navigating user/actor-inputs, management strategies, models, legislation and politics, which he or she encounters when designing new products, services and systems. Navigation is used as a metaphor by many scholars, e.g. in management and innovation literature, describing how their companies should cope with, and adapt to, changes and challenges in new landscapes (Hitt et al., 1998; Vincent, 2008). Similarly, Dawson describes workplace changes as *'an odyssey, which whilst generally being planned, requires the continual revision of navigational decisions to meet unpredictable and unfolding conditions'* (Dawson, 2000). The metaphor of a design project as an exploratory journey stands in sharp

contrast to the linearly depicted design process used in engineering design and often represented by stage-gate models (Cooper, 1990), used as a project management tool in organisations, by highlighting the uncertainty of a design process. A designer might have an overall plan, a route, but navigation is also about handling the unexpected, seizing opportunities, and dealing with challenges when they arise. As described by Berreman (1966), Thomas Gladwin has written an article where he investigates the navigation styles of Europeans and Trukese which are quite diverse. The European style is about setting a course and sticking to it, while the Trukese instead of having a course, have an objective to steer towards using the sun, wind waves etc. to navigate. The European style requires planning, while the Trukese style requires agility. But conducting a successful journey would require both tactics, since planning is a way to prepare for the unknown and giving a direction to steer towards, while agility enables you to manoeuvre your ship to deal with immediate challenges such as rocks and perhaps also dangerous sea-monsters.

The same goes for a design process: There should be an overall plan in terms of who to involve, how, and at what stages in the design process. This means that design interactions should be prepared (staged) to make sure that each interaction produces a useful outcome that contribute to the process. At the same time these interactions are to be facilitated using an agile behaviour to deal with unexpected insights and challenges. Hence it seems that navigating a design process require a mix of preparation and agile behaviour, which I will try to master on my PhD-journey (see Figure 1).

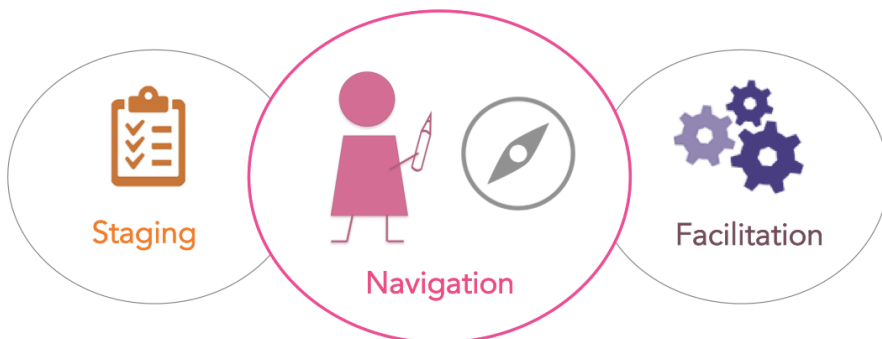


Figure 1: Design as navigation

PLANNING THE JOURNEY

Planning the journey first and foremost require a mission, a direction and a compass to set the course:

THE MISSION

A key factor when involving not only end-users but also numerous diverse actors in participatory design processes, is sharing knowledge across different backgrounds, cultures and skills, and between people who might have difficulties understanding each other. As I heard a person on a seminar focusing on Public Private Innovation partnerships in healthcare settings say: 'We all speak Danish, but it is as if we do not speak the same language'. The role of participatory designers is to enable knowledge sharing and mutual learning across cultural, professional or organisational borders by empathising with the diverse actors and being able to understand their perspectives. But how is this done?

I make it my mission on this journey to investigate and provide an operationalized approach for translation of knowledge in a healthcare setting. The mission involves four aspects:

1) Explore how knowledge is translated in participatory design practices in a business context, 2) to develop an operationalized approach for design practitioners, 3) to inform the scholarly discussions on ANT and Participatory Design based on insights from case studies, and 4) to inform the healthcare setting.

WHERE TO EXPLORE?

I set out with a profound wish to make a difference in peoples lives by designing products, services and systems that improve their lives and situation. This desire is reflected in nearly all my experience as a design engineer having a relation to the healthcare sector. Characteristically of the healthcare sector is the complexity of public and private actors who have different goals and motivations. Szebeko and Tan (2010) coins the complexity: '*Adapting, changing and continually innovating healthcare is a complex undertaking requiring contributions from many different stakeholders including governments, professionals, carers, patients and the general public.*' (p. 580). These actors have diverse backgrounds and distinctive opinions of what is important in life, and they value different types of

knowledge. E.g. the health professionals are often brought up with quantitative studies and knowledge based on clinical trials, while the knowledge concerning patients regularly is of a qualitative nature. I am intrigued and motivated by the complex nature of this setting, as involving end-users in design processes is one thing, but involving a number of diverse actors in design processes seem to be a real challenge. This setting provides a unique view into how knowledge is translated in interactions with actors from outside a company in charge of a design process as well as between actors internally in the organization. Driven by my curiosity about the challenge, I set my course towards the land of Healthcare.

The land of Healthcare

Healthcare is a fairly large country consisting of a large mainland and a number of small islands representing various Pilot Projects and design projects.



Figure 2: The diverse and complex land of Healthcare

The population of Healthcare is extremely diverse. Patients, relatives, doctors, nurses, therapists, hospital directors, innovative companies, municipalities, regional procurement officers and politicians are all part of the Danish healthcare sector, and have very different incentives for and measures as to how they bring value to the sector. In Denmark, 90% of the health-providers are public entities, which means, that the entire population has access to healthcare services free of charge. The downside is, that public hospitals needs to focus on cutting costs leaving less room for design and innovation activities (P. B. Jensen et al., 2013; Udbudsrådet, 2012; Weihe et al., 2012).

According to three knowledgeable actors from the healthcare sector; Jens Ole Pedersen, Director of Philips Healthcare, Henrik Schødts, project manager at the new hospital of Northern Zealand, and Per Christiansen, CEO of the Regional Hospital in Denmark, the 'country' is generally powered by conservatism, as nobody wants to take risks when it comes to people's health. However, there is indeed also an acknowledged need for trying new things, as the prospects for Healthcare is that due to demographics the future seem to consist of fewer young people to take care of a majority of elderly and sick people. Hence, currently there is a lot of focus on initiating pilot projects for innovation and the development of new products and services to help cope with these prospects. The pilot projects are initiated based on the idea that public and private entities, as well as the patients, should work together in a collaborative manner. This, however, has in many cases proved a challenge (Brogaard & Petersen, 2014). And from the seminars I have participated in, it seems that this has to do with difficulties in communication and knowledge sharing - which the quote on page 7 also bears witness of.

MY COMPASS (RESEARCH QUESTION)

So to help me set a course towards the land of Healthcare, and make navigational decisions, I have converted the four elements of my mission into one research question that represents a compass guiding me on my journey.

How to use theoretical elements from ANT and practical approaches from Participatory Design to inform design practitioners of how to navigate design processes with objects and a multiplicity of actors in order to enable knowledge sharing and development of products, services and systems in global healthcare sectors?

FINDING AND STOCKING THE SHIP

The last thing I need to do before I set sails is to find a ship. Using the journey-metaphor, this PhD-project can be seen as the ship, which enables me to embark on this new adventurous journey. A ship which I have designed, build and modified myself, but which also has a structural core consisting of the TempoS project (Performing Temporary Spaces for User-Driven Innovation), which is a multidisciplinary research alliance whose core aim is to explore and describe contemporary methods and new approaches in user-

driven innovation, funded by the Danish Strategic Research Council. The alliance consists of Aalborg University in Copenhagen, Copenhagen University and The Royal Danish Academy of Fine Arts, School of Design.

Also, the ship contains a library with two main sections, ANT and Participatory Design, which my amazing colleagues at Aalborg University in Copenhagen inspired and helped me stock. In Chapter 2, I will introduce my library, which have influenced what I was looking for and found during my trip. But first, I will describe my initial navigational moves, which led me to find some focus in the project.

MY INITIAL NAVIGATIONAL MOVES

At this point in the story, I have my ship (the PhD project), my mission, my compass (research questions) as well as an area I wish to explore (healthcare). So it is time for me to go explore the world. I participated in an event in Copenhagen called 'Capital Region's Health Days' (Region Hovedstadens Sundhedsdage) to get in contact with engaged actors from the field. Capital Region's Health Days is a family-oriented 2 days event where healthcare professionals and private companies are showcasing their ideas and work to the citizens of Greater Copenhagen. I used this opportunity to talk to Jens Ole Pedersen, current director of Philips Healthcare in Denmark, and Business Development Manager at Philips Healthcare at the time. We had a casual conversation about the work and goals of Philips, and eventually ended up arranging a meeting to discuss and plan how I could follow the design efforts of Philips in my PhD. Philips is an extremely interesting company, because they strive to be frontrunners within designing not only hospital equipment but also services and systems – which is right up my alley! They have a tradition on focusing on hospital environments designing especially picture-diagnostics-equipment such as scanners for hospitals around the world, but recently they strive to be part of the entire health continuum including prevention and rehabilitation. Also the fact that Philips has their headquarters in Eindhoven was an interesting chance for me to both engage with the Danish healthcare sector as well as gain knowledge about international sectors. A new partnership was born.

READING GUIDE

As already indicated, the structure of this dissertation is inspired by the metaphor of seeing my PhD as an exploratory journey to the land of Healthcare. The metaphor helps me highlight my navigational moves during the PhD-project, while choosing to embark on certain islands (see Figure 3) and managing to get in contact with different actors along the way.

Chapter 2 contains information about my research design and how I have navigated my PhD. Chapter 3 is a presentation of my library aboard the ship that allows me to analyse and reflect on my findings and experiences along the way. In Chapter 4 my journey begins, and I set sails towards the, the PPI Island, where I learn about the 'new sensory delivery rooms of the future' designed as part of a Public Private Innovation (PPI) project. In this chapter, based on my experiences at the island, I offer a new sensitising device for looking into the navigation of design interactions called Prototyping Spaces. In Chapter 5 I sail towards the fairly larger and more populated OI Island where I meet a company striving to involve patients, relatives, doctors, therapists as well as internal actors in their Open Innovation (OI) design efforts of developing a new app concerning stroke care. Based on my experiences at this island I further add to the concept of Prototyping Spaces by introducing more configuring elements to the space as well as offer more insights to the designer's role as the navigator.

In Chapter 6 I sail to the last, and probably most exotic, island on my trip, the PSS Island near India, where I revisit a design project which I was actually part of myself some years ago designing a Product Service System (PSS) to the poor people of rural and slum areas in India in collaboration with a number of different local actors. Learning from the previous encounters of my trip and building on the concept of Navigating Prototyping Spaces, I direct attention towards the idea of designing networks of objects and actors rather than focusing on designing objects, and promotes negotiation among actors is a central element of the network-building. In Chapter 7 I summarise my findings and point to my contributions in terms of using the sensitising concepts of Navigating Prototyping Spaces to highlight the navigational aspects of Participatory Design and point towards operationalized strategies and methods for navigation in Participatory Design.

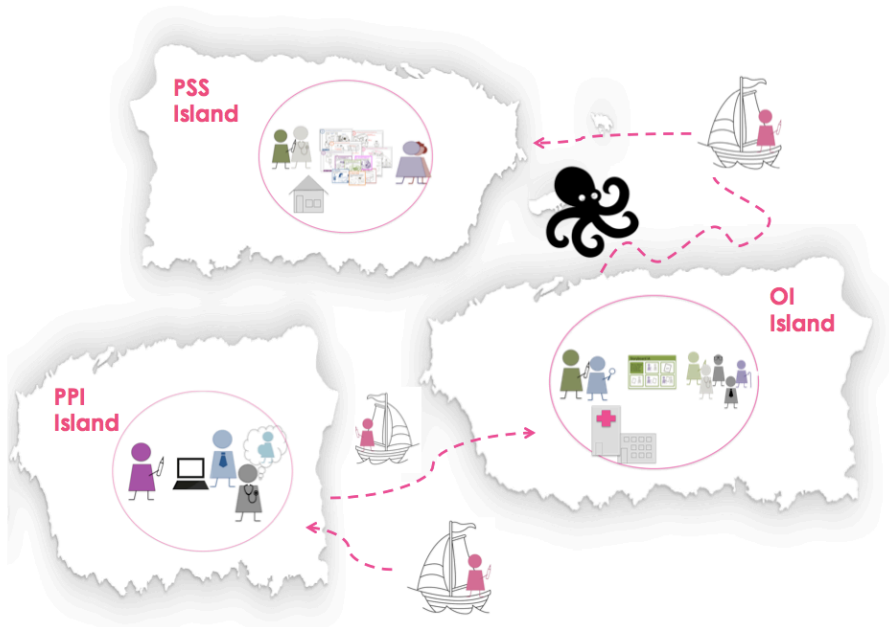


Figure 3: Illustrating the three main islands (cases) of this summary

The appendices of this summary contain my three articles:

1. The Sensory Delivery Rooms of the Future: Translating Knowledge Across Boundaries in a Public-Private Innovation Partnership
2. 'Staging Prototyping Spaces' – Navigating boundary objects to interest actors in design processes
3. Staging Co-design Of Actor-Networks (together with Søsner Brodersen)

To form a cohesive storyline in this summary, I have chosen to draw inspiration from my articles, rather than presenting each of them in full. I take a starting point in the cases presented in the three articles and introduce my main contributions when relevant for the summary storyline. These discussions involve ownership and translation of knowledge using prototypes as boundary objects from article 1 (Pedersen, 2015), discussions of the roles and properties of prototypes as boundary objects to form the bases for the development and introduction of the sensitising device Prototyping Spaces

in article 2 (Pedersen, 2016), and lastly a sensitivity towards designing networks of objects and actors rather than only having objects as the object of design in article 3 (Pedersen & Brodersen, 2016). I suggest the reader to get familiar with the three articles before reading the rest of this summary. However, as I have a more profound overview of my material at this stage, some of the conclusions and arguments from the articles have been further developed for this summary.

CHAPTER 2. NAVIGATING MY PHD

In this chapter I will introduce my research design in terms of introducing my approach, my methods, my level of involvement in the cases I have studied, and eventually argue for choosing the three cases presented in this summary.

My research design and my navigational moves and decisions along the way, have been influenced by my theoretical approach based on ANT's ontology of seeing networks as being continuously (re-)configured by human and non-human actors, as well as my practically oriented approach inspired by Participatory Design. I am not the first attempting to combine ANT and Participatory Design. E.g. Linde (2012) coins how ANT can contribute to Participatory Design: *Actor-network theory can be understood as a semiotics of materiality and have potential to help us, as designers, to analyze relational and non-singular aspects of objects. Properties and forms of entities (things, objects) are acquired in relations to other entities* (Linde, 2012, p. 9). Inspired by this, conducting my research means being attentive towards hybrids of relations between users and other actors as well as objects like prototypes, documents, illustrations etc. that might help me analyse how knowledge is represented and translated during a participatory design process.

AN EXPLORATORY VIEW

While engaging with the field and searching for hybrids, I was well aware that the relations I sought to identify between human and non-human actors were not 'already out there' and given a-priori, but instead something to be explored and identified using ethnographic research methods such as observations and semi-structured interviews as well as design interactions in the form of design games (Brandt, 2006). This exploratory approach also entailed investigating an issue from different sides, not only taking into account the version of a specific type of actor (e.g. doctors vs. patients). According to Storni, *'The alternative non-modern, agnostic approach discounts any a-priori assumption as to which knowledge or perspective is more relevant or superior to design or evaluate'* (Storni, 2015), which to me means, that I do not think higher of the knowledge of e.g. doctors as supposed to the knowledge of patients. They both provide meaningful insights, and should both be represented in the design process. This is in

perfect alignment with the Participatory Designers who state that many different actors should be involved, so many voices are heard and gives shape to the project (Bratteteig & Gregory, 2001; Simonsen & Robertson, 2012).

PREPARING THE JOURNEY – VISITING DIFFERENT SITES

In the introduction I indicated how navigation might prove an important element of the design process. Preparing and facilitating both process and interactions seem to be important aspects of navigation, which I have also used during my PhD-journey. When being an explorer you are preparing and planning for uncertainty while demonstrating agile behaviour to cope with challenges and making navigational decisions along the way.

As in almost any design process, I expect the journey to have detours and iterations, but I put my faith in knowing that these detours are essential for my learning process. An exploratory journey is not only about getting to the desired destination, it is also very much about the lessons learnt on the journey. As Patricia Hampl puts it: *'There can be no pilgrimage without a destination, but the destination is also not the real point of the endeavour'* (Hampl, 1987).

I knew from the beginning, that I would visit several islands, making my research multi-sited (Marcus, 1995). I wanted to engage with, and learn from, different healthcare related design projects at different 'sites' to follow co-design activities focusing on translation of knowledge in different actor-constellations and approaches. The multi-sited approach offers the possibility of seeing patterns and takes up relevant issues across different design projects. Hence I will seek to demonstrate similarities and differences across the sites and attempt to come up with somewhat generalizable aspects. In total I have conducted research at five different sites represented by the five islands in the figure below: The PPI Island (The Public Private Innovation project: sensory delivery rooms of the future), the OI Island (The Open Innovation project: stroke-app), the PSS Island (The Product Service System of bringing insulin closer to the patients in India), the CE Island (circular economy – a new public procurement tradition in the Danish healthcare system) and the ME Island representing a lighting project at Gentofte Municipality in Greater Copenhagen.

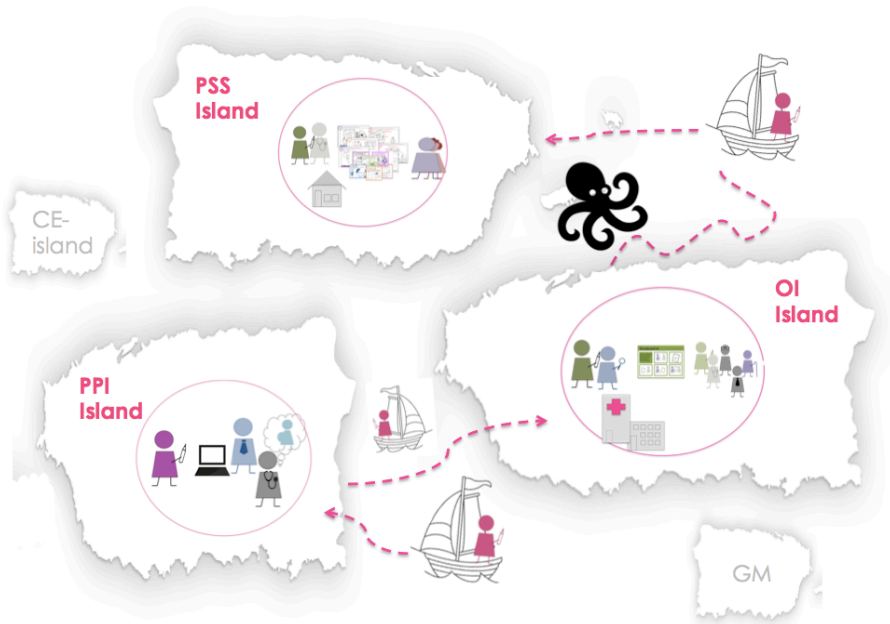


Figure 4: A map of my journey illustrating my route and the Islands I encountered

GATHERING EMPIRICAL MATERIAL

ETHNOGRAPHIC PARTICIPATION

Due to my curious nature, I was eager to engage with ‘the field’ right from the beginning. The ethnographer emerges into, and gets to know new settings by participating in these, and developing relations to the people involved (Emerson, 1995). When I was able to, I have emerged myself in the setting, which I studied, and my background as a designer, enabled me to actively participate in at least two of the projects, which I have studied through ‘participant observation’. I have never fooled myself to believe, that I could be an objective observer in my research, and neither have I wanted to be. Even though my presence, and my engagement in the design projects I have studied, might have implications and consequences for what is taking place, the work of Emerson advocates that instead of ‘contaminating’ what is observed, rather *‘first-hand relations with those studied may provide clues to understanding the more subtle, implicit underlying assumption that are often not readily accessible through observation or interview methods alone’* (Emerson, 1995, p. 2).

My abilities as a design engineer, has provided me with ethnographic methods to conduct field studies, and I have used a range of ethnographic methods such as observations, follow the actors and semi-structured interviews – often conducted as ‘friendly conversations’ (Spradley, 1979). According to Spradley, ethnography is about learning from people, which is why Participatory Design scholars often use ethnography early in the design process – to learn.

I will give a brief introduction to the sites I have studied while presenting the methods I have used for studying the projects.

DESK RESEARCH AND INITIAL FIELD WORK

I conducted a lot of desk research in the beginning, to learn about the efforts of already finished PPIs as well as on how users and other actors were involved in the design processes. I found a lot of project reports and worksheets, which were delivered as documentation for PPIs, and I also read evaluation reports summarising the experiences of a number of PPIs in relation to each other. Together with my participation in a number of PPI-seminars, workshops, and interviews with public and private actors in the field of welfare technologies, I learned, that the communication between the members of the project teams proved difficult, which further added to the already existing divide between public and private entities. The public entities have a tendency to distrust the private entities, and they sometimes experienced, that actors from the private companies was only interested in making money and finding good business-bases, while the public entities wanted to provide a better service for their users. I wanted to learn from a successful PPI, where they managed to overcome some of these challenges, and I already had contact to Jens Ole Pedersen from Philips, which made the sensory delivery rooms of the future-project the obvious choice.

PPI ISLAND: SENSORY DELIVERY ROOMS OF THE FUTURE

This was my first real engagement with the field. I was eager to learn what had made this particular project a success, and since the project had already finished, I set out to do qualitative interviews with representatives from all actors in the project team: the midwives (who was the main users of the delivery rooms), Philips Lighting (hardware supplier) and Wavecare (design company). Since the project had just finished, I was quite sure that the team members could recall the events. I also set out to see the new delivery rooms, so I would know what they talked about when describing details of

the installation. I prepared an interview guide to use in all three interviews, to hear each party's version of the events. The focus of the questions revolved around their experiences being part of a Public Private Innovation-project, and how/if it was different from 'normal' projects. Furthermore, I wanted to explore the nature of their collaboration. Who initiated the project, and how was it driven forward.

To make the interviewees comfortable, I always sent the interview guide to them beforehand, so that they would know what I wanted to talk to them about, and what sort of questions I wanted to ask them. However, I also stressed, that they were not to prepare a speech based on the questions, as I was also very open to new elements. Also, all the interviews were conducted at a location where the interviewees had their daily activity. The purpose was twofold: to make the interviewees feel comfortable, and to allow me a chance of seeing their workspace, and hence get an idea of how they worked and shared knowledge on a daily basis. E.g. Wavecare's studio was big enough for creating 1:1 mock-ups of new installations, and had an open and experimental feeling. In contrast, the Philips headquarters in Copenhagen is a classic office space with computers, desks and meeting rooms, and during the conversation I learned, that billable time is one of their main parameters on which the employees are measured. Hence, being in these settings, gave me an idea of the project participants' motivations and ambitions.

OI ISLAND: THE PHILIPS STROKE APP

After looking into the Danish PPI-setup, I wanted to engage in an even more complex context where many different actors were involved at different moments in the design process.

I will not try to hide, that there was also an element of chance related to how things turned out. Every interaction I had with different actors was about planting a seed that would perhaps grow and get me contact with someone, who would generously allow me to follow an interesting PPI setup. Based on my initial talk with Philips Healthcare leader Jens Ole Peder- sen, I was invited to participate in design activities at Danish hospitals (e.g. being a translator for a group of Philips employees visiting from Eindhoven – and ending up doing participant observations while conducting the actual interviews with the patients and translating the knowledge and insights gathered to the Philips employees as well as to the hospital staff). This of-

ferred a unique opportunity to see how Philips researchers and designers collected insights, and how they translated these insights to their colleagues through presentations with quotes, pictures and patient-journeys. I also participated in a promotion trip to Eindhoven together with practitioners from the Danish healthcare sector, which gave me a unique opportunity to engage in informal conversations with these and learn about their experiences and challenges working together with private companies such as Philips.

After this trip, I became involved in a Philips Research project managed from the Philips headquarters in Eindhoven, Netherlands. I offered my expertise as a design engineer in exchange for access to follow the projects and subject my own body and personality to better understand the situation of the actors and the context that I am looking into through participant observation (Goffman & Lofland, 1989). I engaged through moderate participation (Spradley, 1980) in the form of participant observation introduced by DeWalt et. al. (1998), as I actually conducted the design interactions with doctors, patients, relatives etc. at hospitals in Denmark in the initial phases of the project, whereas I had informal, friendly conversations with the Philips employees continuously during the rest of the design process, to learn about their progress. This approach has had both pros and cons. On the positive side, I have gained access to a lot of in depth knowledge about the design processes I have studied, which allows me to reflect on a very detailed level about the staging and facilitation of many of the activities. Furthermore, I have been allowed inside a 'circle of confidentiality' where I have gained a lot of informal knowledge from various sides. On the negative side, however, I might also have been biased and has taken things for granted, which I have been part of myself. Even though a researcher is never completely objective and always influences the field which he or she is studying, I have indeed influenced the practices, as I have conducted them myself, which also involves 'thinking on my feet' (Schön, 1984) based on my previous experience. A researcher always influences her own field to some extent simply by engaging with it, and this is even more the case then engaging in participant observation. However, I am very well aware of these pitfalls, and I have engaged in many dialogues with my supervisors as well as the people from the islands, to 'triangulate' insights from different perspectives. (Argpis & Schön, 1978; Latour, 2005) and be open to other interpretations.

During this project, which took place over a period of around 1,5 years, I spoke with 7 patients, 8 staff and 4 relatives during four days at Bispebjerg and Odense hospital in Denmark. On average, each interview took around half an hour, depending on the energy of the patient and the schedule of the staff. Furthermore, I engaged in three days of design activities with the project team in Eindhoven, which was a good opportunity for me to meet people in person, and have informal conversations with them e.g. over lunch, to discuss more general aspects of being a designer and a researcher as Philips. Also, I participated in testing the next iteration of the app on two occasions with 4 neurologists at Hammel Neuro-clinic in Denmark. And furthermore, during the project period, I had a number of informal conversations and e-mail exchanges with Philips staff to learn about the progress and their way of working and translating knowledge.

PSS ISLAND: BRINGING INSULIN CLOSER TO THE PATIENTS IN INDIA

This project is a rather special one. This case is based on the analysis of a project I did before returning to the university and doing this PhD. During a period of around 3 months, I was an external consultant for a large, Danish pharmaceutical company doing a project where I gathered insights from different actors in India, and translated these findings into a system of how to deliver insulin to poor people with diabetes in India.

Hence, in this project, I was the one navigating a large part of the design process, which both entailed planning and agility (as I will come back to in relation to the case). This means, that I am even more part of this case, and potentially I am a bit biased in terms of finding this a useful way of doing participatory design. Also, the project took place back in 2011, and hence I might have forgotten some of the details. Luckily I took a lot of field notes, and I still have the elaborate substantial final delivery report for the pharmaceutical company, where the main insights are presented. And though I am aware, that I might have some biases in terms of this case, it also has its advantages. E.g. in this case, I have very detailed knowledge about any decisions and events which took place during the project, which means, that this case will encompass and illustrate many of the nuances of my analysis. Hence, in this dissertation, I use this case to see new elements in the analysis, but also to sum up a little bit, in terms of the analysis done in the previous cases.

This case is based on engagements on a more or less formal basis with around 20 patients and 10 experts (doctors, NGO-workers, company representatives etc.) in India. Furthermore, I engaged with the contact person from the pharmaceutical company in Denmark on three occasions to plan the project, handing over the findings, and following up in terms of implementation of a pilot project in India.

OTHER ACTIVITIES

Due to issues related to funding, I became involved in a project about circular economy, where I also managed to get Philips involved. This meant, that I could learn even more about the company's activities in Denmark, and engage with doctors, the director of the Main Hospital in Denmark as well as public procurement officers. And based on my involvement in the sensory delivery rooms-project I was invited to do an evaluation of a design project between a publicly owned group home for people with a psychiatric diagnosis in Gentofte municipality. The project was interesting, and I used my people-skills to engage with a number of different actors including some of the mentally ill living at the group home. And last but not least, I have planned and conducted a one-week intensive participatory design course in Nepal with researchers from Kathmandu University.

And although every island has contributed with interesting interactions, discussions and empirical material, in this summary, I have selected three main sites or cases, which allows me to make a cohesive analysis, as they offer quite detailed insights as to how knowledge is translated during an entire design process in a complex setting, where many actors are involved in the design process. These sites are: The sensory-delivery rooms of the future, the Philips Stroke app, and Bringing insulin closer to the patients in India. The chosen projects have grown in complexity along the way, enabling me to continuously build on layers of knowledge and challenge myself.

SYNTHESISING THE EMPIRICAL MATERIAL

As proposed by Emerson (1995), I have noted down all my experiences and insights from the field in log books in different ways serving different purposes. In the process of writing down the notes, I tried to make the notes as descriptive as possible making thick descriptions (Geertz, 1973) of what I observed and experienced: what people said, how they said it, what they

did and how they did it, but also how I interpreted these situations. However, in order to be able to use the notes actively, I translated and transformed them in several ways. E.g. I produced 'deliveries' to the project team at Philips containing many insights learned during my interactions with different actors in relation to the stroke-project, and I translated the insights into maps and illustrations which I used as boundary objects (Carlile, 2002; Star & Griesemer, 1989) to engage with my supervisors.

ENGAGING WITH MATERIALITY

Visualisation in terms of producing maps, illustrations, prototypes or other types of material representations, has been a key element in this dissertation. Drawing from my background as a design engineer, I am used to visualise my thoughts. I use illustrations to engage in reflective conversations (Schön, 1992) with the drawings in the process of developing these drawings into new insights, but also very much for structuring my conversations and negotiations with different actors. Drawings, mock-ups and prototypes are perfect for interactions with the aim of mutual learning and transformation of knowledge (Carlile, 2002; Henderson, 1991; Simonsen & Robertson, 2012). Also approaches building on the American Pragmatism such as Situational Analysis by Adele Clarke (2005) has visualisation in the form of map making as key elements for structuring knowledge, and gaining an overview of e.g. empirical data, and even Latour poses a challenge to designers of drawing things together and visualising controversies (Latour, 2008).

With inspiration from Clarke, I have drawn and used maps actively during my process to structure my knowledge, identify relations, and share my findings and insights with my supervisors and to remember my findings in an easy way. Furthermore, these maps are interesting, as they represent the different stages of my development during the PhD-project. I can actually see how my views and knowledge has evolved during the process, and help me remember where I came from.

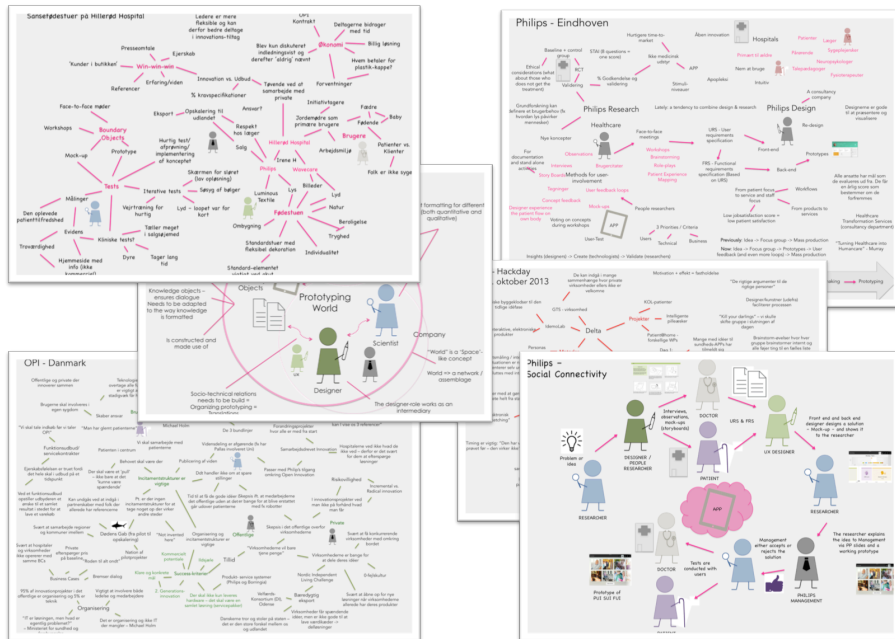


Figure 5: Collage of different maps produced during my PhD

Now the time has come to go into more detail with the theoretical and methodological approaches of my work, as I will introduce you to my ship library, which mainly consists of literature from the fields of Participatory Design and ANT.

CHAPTER 3. INTRODUCING THE SHIP LIBRARY

THEORETICAL FRAMEWORK – THE SECTIONS IN MY SHIP-LIBRARY

My research is centred on a collaborative setup of private companies, public hospitals, designers and non-designers. Such collaborative efforts require that knowledge be shared between actors from very different worlds. Having sensitivity towards collaborative design activities in a business context will illuminate not only how knowledge is translated between designers and users, but also how knowledge about users is translated and circulated between designers and various actors inside an organisation. For this endeavour I introduce Participatory Design and ANT as they both deal with transformation and translation of knowledge, and the special element of these two theories, is that they are sensitive towards the role of materiality such as mock-ups and prototypes in knowledge sharing. They share the ontology of humans and materiality playing a central role in translation and transformation of knowledge. And both point to design being a political process filled with negotiation and discussion. However, their individual contributions are still somewhat distinct. Participatory Design provides insights and operationalized methods and approaches into the professional practice of involving actors in designing new products, services and systems. And ANT provides a theoretical foundation for considering which actors to involve, and how these are navigated to share their knowledge and play a part in the network of allies constituting a final design or solution. Furthermore I draw from boundary object theory that informs how objects, such as prototypes, might help form a basis of knowledge spanning activities. The prototype-literature adds to this discussion by providing a number of prototype features and observations on how to foster this, while also promoting prototyping as a continuous process. I also introduce Navigation (Staging and facilitation) as a sensitising device to provide useful concepts and highlight how this materiality and the many actors are to set into play.

Let us dive into one of the main sections of the library, starting with the Participatory Design section. However, before we do so let me first introduce what I mean by 'design'.

DESIGN AS A PROCESS

Traditionally the word design was closely linked to products as the term was typically used in arts and crafts. Today however, we design everything from drugs to welfare systems (Ilstedt Hjelm, 2005; Latour, 2008), and design is seen as a process of change: *changing artefacts as well as changing people, organisations, communities* (Bratteteig & Gregory, 2001). This shift, stemming back from the 70'ties, means, that the designer is required to have a more diverse set of skills than mainly creating beautiful shapes and products. A change-process is also a social as well as a political process (Bucciarelli, 1994; Halskov & Hansen, 2014; Simonsen & Robertson, 2012), and now the designer, in addition to being a creator, is also a navigator that communicates and negotiates among numerous actors. These competencies are required in a number of different professions, and in line with Andreasen et. al. (2015) I use the word 'designer' in a broad sense referring to any trained person who designs something whether it be a design engineer, a people researcher, a UX designer or the like. However, based on previous experiences and a belief in the value of involving also non-designers in the design process, I specifically deal with a particular type of designer – the 'participatory designer'.

'PARTICIPATORY' DESIGN

Participatory design is a special tradition in design built on a foundation of democracy and change (Bratteteig & Gregory, 2001). These principles advocates that people who are going to use a product or solution are also involved in designing it (Namioka & Schuler, 1993). And especially the voices of the otherwise marginalised actors should be heard to give them ownership and encourage participatory democracy.

Participatory Design has its roots in the 1970'ties where collaborations between unions and action researchers meant that shop-floor workers were engaged in designing new IT systems for their workplace (Sandberg, 1979; Simonsen & Robertson, 2012). The trade unions and the workers feared that the introduction of computers would make their skills surplus and replaced

by automated computers. The workers were unable to imagine a future where computers were useful tools rather than competitors, and so Participatory Design became a way to involve the workers and to encourage them to imagine possible futures.

However, Participatory Design is not only satisfied involving end-users as partners. Participatory designers seek to involve actors at many different levels to shape the changes from several perspectives (Bratteteig & Gregory, 2001). *'This includes (top) management, future users, and internal and external groups that at a later stage become involved in the technical and organisational implementation of the proposed visions'* (Simonsen and Robertson 2012, 125). In line with these statements and to further highlight the importance of involving a range of diverse actors in the design process, I propose to involve 'actors' and not only 'users' into the design process. Involving many different actors, however often result in conflict and controversies like e.g. conflicts between management and shop-floor workers in the early years of Participatory Design (Andersen et al., 2015; Gregory, 2003). Hence Participatory designers need *'to deal with issues raised during collaboration in design, including how to negotiate conflicting constraints and values, make visible diverse stakeholders' interests and knowledge, and assess design success...'* (Cherkasky, 2003, p. 11). Dealing with conflicting worldviews and interests require negotiations, and the silver lining is, that conflicts facilitates mutual learning and create new possibilities in design (Bødker, 1987). Mock-ups and prototypes are tools to enable this mutual learning and give actors a voice in the design process, as these types of materiality enables communication between developers and users without technical knowledge (Andersen et al., 2015; Simonsen & Robertson, 2012). And using mock-ups and prototypes captures an important mantra of Participatory Design: 'design by doing' (Björgvinsson et al., 2012) that entails materialising and testing concepts and ideas.

To place the core values of participatory design in a broader context and identify what is unique for the participatory design tradition, let us now see how other design approaches promotes engagement with various actors during the design process.

A MULTITUDE OF APPROACHES AND TRADITIONS FOR INVOLVING ACTORS IN DESIGN

Besides from Participatory Design, a number of other design traditions also involve non-designers (often end-users) in their development processes. As I am investigating design projects in a proprietary setting, and have an interest in how organisation manages design in terms of translating external user-knowledge into new, innovative solutions, I have drawn inspiration from the Design & Innovation Management tradition. Reading about different approaches, it quickly becomes evident, that there are many degrees of involvement of actors in the design process. Some projects or organisations claiming to be participatory or user-centred only invite potential users to participate in the final stages of the design process where the final solution is evaluated before product launch. In other projects, mainly the ones associated with a User-Centred Design approach or Design Thinking, the designers see themselves as experts studying the users in the beginning of the project and using this information to come up with solutions single-handed. In contrast, Participatory Design builds on a collaborative approach, where the users are seen as partners in the design process (often referred to as 'genuine' participation) (Simonsen & Robertson, 2012).

According to Sanders and Stappers, the two traditions of Participatory Design and User-Centred Design has in recent years evolved towards each other to become what we today call co-design, which is defined as *'the creativity of designers and people not trained in design working together in the design development process'* (Sanders & Stappers, 2008, p. 6). In this summary, I will continue to use the terminology of Participatory Design to emphasise the ideas of democracy and involvement of numerous actors in the design process.

User-Centred Design and Participatory Design are not the only approaches to involve users in design processes. In design and innovation management traditions such as Open Innovation (Chesbrough, 2006), the term co-creation (Piller et al., 2011; Prahalad & Ramaswamy, 2004a, 2004b) is used to describe how users actively contribute to the development process. Design and Innovation management is the business side of design, and plays an integrative role in the interface of design, organisation, and market. The users represent the market, and while Participatory Design is focused on negotiation and mutual learning between designers and users, customer

co-creation is based on the premises that end-users themselves are capable of coming up with innovative ideas. Examples would be 'lead users' promoted by von Hippel (2005) that might design new products ahead of market needs, idea competitions called by companies and won by customers presenting the best ideas, and 'hackatons' called to encourage participants in cross-disciplinary teams to generate new ideas in facilitated workshop settings (Marais & Shutte, 2009). For the company, this requires less time and in-house skills than finding and engaging numerous actors in a qualitative manner as partners in the design process. And this might be part of the tendency of companies using co-creation methods rather than participatory design. Though Participatory Design has been around for a while, the industry has not yet fully embraced this approach. One reason might be, that Participatory Design has been criticised of being an academic endeavour too focused on development of methods and too far from the 'market' (Buur & Matthews, 2008). With their concept of Participatory Innovation, Buur and Matthews draws on elements from both Participatory Design and co-creation to combine the industry focus on markets with methods from Participatory Design of involving, not only end users, but a whole range of actors in the design process.

Inspired by the mapping technique used by Sanders and Stappers (2008), I have illustrated how I see the relation between Participatory Design and Design & Innovation Management (see Figure 6).

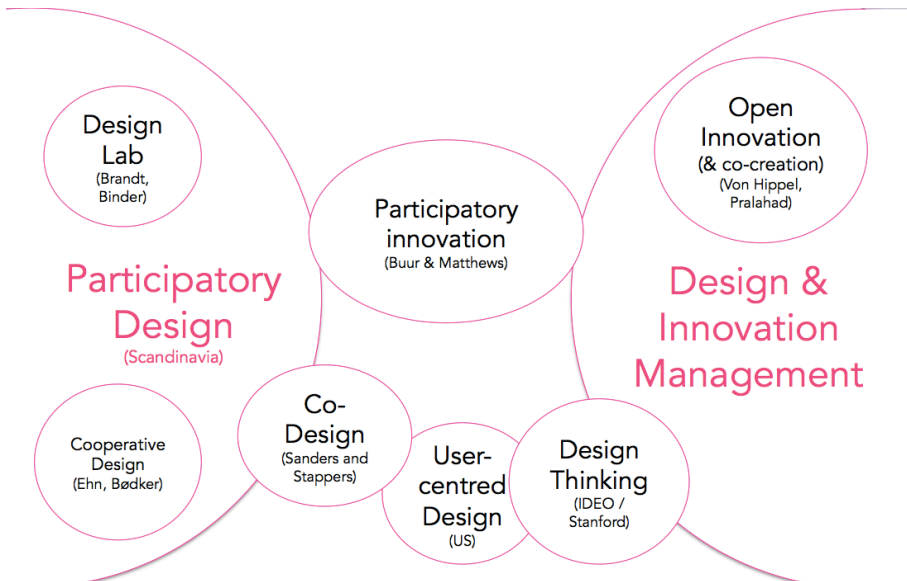


Figure 6: Mapping the different design concepts in relation to their familiarity with Participatory Design and Design & Innovation Management

Participatory Design has a focus of democracy and involving users as partners in the design process, whereas Design & Innovation Management mainly sees the users as 'the market'. Also other approaches of inviting users into the design process is included in the map and generally the approaches to the left are oriented towards actors outside the organisation, while the approaches to the right focus more on organisations.

From the map it is evident that there are quite many interesting approaches in the continuum between Participatory Design and Design & Innovation management. One element emergent in many of these approaches is iterative 'prototyping'. Mock-ups and prototypes are important in Participatory Design for mutual learning, and is also a core element of Design Thinking. But while literature highlights the role of prototypes for mutual learning, it does not necessarily shed light on how the outcome of these interactions is brought forward in the design process in terms of being used in new interactions and eventually represented in the final solution. This is where ANT comes in, as this tradition uses the concept of *translation* to describe the process of building networks. And according to ANT both knowledge but also actors should be 'translated' to support and negotiate the final solution.

AN INTRODUCTION TO CENTRAL CONCEPTS IN 'CLASSICAL ANT'

Actor Network Theory is originally developed and promoted by Bruno Latour and Michel Callon (1981), and is further developed by Callon, Latour and Law (Lauritsen et al., 2007). It stems from the late 1970'ies where Laboratory Studies was initiated taking a starting point in ethnographic studies and accounts of the way for instance a laboratory scientist manipulated his surroundings to become allies in his work of constructing scientific facts (Lauritsen et al., 2007). Based on the laboratories especially Latour promoted that scientific 'facts' or 'knowledge' is constructed as a result of heterogeneous network-relations as opposed to being ominously present – making ANT a constructivist approach. And from these studies a 'revolution' within STS was born, as Latour and Callon went on to develop ANT claiming that these network-relations consisted of humans and non-humans both having agency and hence ability to 'act'.

The word 'actor' stems from the French semiotic tradition where it not only refers to people, but to all active entities part of maintaining or expanding networks – human and non-human (de Laet & Mol, 2000; Lauritsen et al., 2007). The ontological claim of ANT is, that humans and non-humans are equally important and hence should be studied symmetrically (Shiga, 2007). This is not a completely foreign concept to participatory designers who engages with both people and physical representations of knowledge. In Participatory Design knowledge or mutual learning is created in interactions between designers, non-designers and materiality such as mock-ups and prototypes, the idea that materiality such as sketches, mock-ups, and prototypes can play a vital role in design interactions, is part of this ontology. Hence, ANT provides a theoretical foundation for considering which actors (human and non-human) to involve in heterogeneous design interactions and processes related to the construction of knowledge.

In line with what we see in Participatory Design, the allies involved, play a significant role in adapting the final solution: *'the fate of innovation, its content but also its chances of success, rest entirely on the choice of the representatives or spokespersons who will interact, negotiate to give shape to the project and to transform it until a market is built'* (Akrich et al. 2002, p. 217). And it is interesting who is invited to participate as representatives and spokespersons – and who is not. This makes design political, as the

designer can choose to include and exclude certain actors. Especially in a Participatory Design project, numerous spokespersons might be involved in the design process with the hope of making them allies and part of the network around the final design solution. And according to ANT, the way to make allies is through the process of translation.

TRANSLATION

I am particularly interested in *translation* as a central element in ANT due to its process perspective and its ability to capture the tensions and negotiations of the network-building activities. Translation of allies refer to a process consisting of 4 moments: *problematization* (a problem/hypothesis is introduced as an Obligatory Passage Point (OPP)), *interessement* (actors become interested in joining the network and starts negotiating the terms of their enrolment), *enrolment* (the roles of the actors are defined and inter-linked) and *mobilization* (the actors actively work for the network's agenda) (Callon, 1986). In the initial phases of a participatory design project, focus will often be on bringing forward an OPP as part of the problematization followed by the interessement of actors to be part of the process with the aim of eventually mobilizing them to play a role in - and speak on behalf of the network.

Problematization and OPPs

In the problematization phase an entity brings forward a hypothesis in the form of an OPP that is dependent of support from a number of actors if it is to become reality. By introducing this OPP, the actors who are to be interested, enrolled and mobilised later on is identified along with the roles that they are supposed to play in the network-relations.

This might be compared to a design company developing a design brief that contains an idea of what is to be designed and for whom. However, participatory designers would advocate that this OPP should be co-designed together with the actors who are being affected by this new solution in one way or the other. This is in contrast to what is seen in quite a few design projects, however, where actors in the form of end-users are only involved in the final testing of new solutions (Sauer et al., 2010; Walker et al., 2002) where it is more costly and time consuming to make adaptations and changes to the solution based on negotiations with the actors. This illustrates the importance of actor-involvement already during problematization and interessement as these phases constitutes the foundation of trans-

lation and entails many negotiations fostered by participatory design methodology.

Interessement

'Interessement is the group of actions by which an entity attempts to impose and stabilize the identity of the other actors it defines through its problematization' (Callon, 1986, p. 8). The problematization is put to the test using 'Interessement Devices' for interesting actors to support the hypothesis brought forward (Callon, 1986; Sage et al., 2011).

In a Participatory Design context, these devices would often involve the use of mock-ups and prototypes representing the OPP to spur negotiations and interest for instance a decision maker. Also the concept of interessement points towards the outcome of these negotiations (the effects of translations): *'Innovation continuously transforms itself according to the trials to which it is submitted i.e. the 'interessements' tried out. Each new equilibrium finds itself materialized in the form of a prototype which concretely tests the feasibility of the imagined compromise'* (Akrich et al., 2002, p. 213). In this quote, the prototype represents the outcome of the negotiations and mutual learning during 'interessement'.

Enrolment and Mobilization

Enrolment and mobilization are the two remaining steps in the process of translation, and entail increasing support from the allies. Once the actors are interested, the next step might be to decide who are to play a role in the final network through a process of negotiating these roles. In a Participatory Design project, the designer might wish to involve actors on different levels. Some actors, for instance the end-users, are to be interested to become enrolled and eventually mobilized to play the role of users in the network of the final solution, while others perhaps only needs to be interested in terms of providing insights that can contribute to the final solution. Creating ownership is often the way to mobilize actors making them dedicated allies as long as the network meets their motivations and desires, which can be done through negotiations in terms of seeing them as partners in the design process.

CHALLENGING TRADITIONAL ANT

Since the introduction of the sociology of translation and ANT, researchers have challenged the somewhat managerial nature of such an analysis. The traditional translation analysis found in the early work of Latour and Callon (Callon, 1986; Latour, 1988) is focused upon illustrating how one key actor (often an entrepreneur) use certain intersement devices to interests and translate allies to support his network either by force or seduction. Diesel, Pasteur, and researchers at St. Brieuc Bay translated a number of actors to support the network they were building from an already existing hypothesis or idea that they wanted to promote (Callon, 1986; Latour, 1987, 1988). This view has over the years received some criticism as it is considered to be too managerial, only telling the story from the viewpoint of the strong actor, thereby neglecting the viewpoints of 'invisible' actors (Lauritsen et al., 2007; Star, 1991). Susan Leigh Star, an STS scholar from the American Pragmatism tradition promoted by Anslem Strauss who was the supervisor for Star, holds one of these critical voices. Instead of having one strong actor manipulating the others, Star suggests an ecological view on collaboration and knowledge production: *'...the viewpoint of the amateurs is not inherently better or worse than that of the professionals, for instance'* (Star and Griesemer, 1989, p. 389), which implies a more democratic approach in line with what is advocated by Participatory Design scholars.

The disagreement between Star on the one side and Latour and Callon on the other can be exemplified by their view on the concept of Obligatory Passage Points, which is another central element of the translation process. In traditional ANT, the OPP is set up by the entrepreneur putting himself and his idea/solution at the centre of the network, with an aim to test whether his hypothesis is in fact valid. All actors, who could benefit from being part of the network, would eventually need to pass through, or align with, the Obligatory Passage point if they wanted to fulfil their desires and motivations. Challenging this view, Star and Griesemer suggests, that a design process might contain several OPPs *'... it is a many-to-many mapping, where several obligatory points of passage are negotiated with several kinds of allies, including manager-to-manager types'* (Star and Griesemer, 1989, p. 390).

Participatory Design adds to the original ANT conception of translation by focusing on democracy and challenging the idea that an OPP, where all actors need to pass by in order to get what they want, can be identified and

remains stable from the beginning of the process. Participatory Design is about negotiation of perspectives, and represents a step-wise and iterative approach where the idea and solution is not settled until the end of the process and is a result of continuous negotiations during the design process.

Other researchers before me have also discussed contributions of Participatory Design to ANT. And even Latour has sought inspiration in design (Latour, 2008). So after introducing the 'Classical ANT', I will now direct my attention towards another section in the library, which is placed right between the two main section of Participatory Design and ANT and draws on newer ANT-works. In later years, Latour has directed his attention towards political issues, which he calls a Dingpolitik where 'matters of concern' are negotiated in 'parliaments of *things*' (Latour, 1993, 2004, 2005, 2008), and these discussions have been a source of inspiration to some Participatory Design scholars. This section in the library contains a selection of the texts where these discussions take place.

CURRENT DISCUSSIONS ON COMBINING ANT & PARTICIPATORY DESIGN

Discussions of the significance of involving actors in innovation processes to support and adapt new designs is not only promoted by the Participatory Design community, but is also reflected in the STS literature. Recently design scholars have recognised the analytical strengths of ANT and have engaged in linking ANT to Participatory Design (Binder et al., 2015, 2011; Linde, 2012; Lindström & Ståhl, 2015; Schoffelen et al., 2015; Storni et al., 2015; Storni, Binder, & Stuedahl, 2012). The newest contributions within this field stems from a recent issue of the CoDesign journal (Storni et al., 2015) where many of the authors engage in discussions about the ideas Latour has of moving from designing and discussing matters of *fact* to instead designing and discussing matters of *concern* (MoC) which are characterised by being rich, complex, surprising and constructed. These characteristics make them political and open up for them to be negotiated at gatherings or *things* (socio-material assemblies revolving around matters of concern). The concept of *things* is Latour's development of Heideggers notion of *Dinge*, referring to a gathering or an assembly of representatives and a procedure where objects are presented to the 'parliament' in a democratic and legitimate way (Latour, 2004, 2005). Such settings are what Latour calls

Parliaments of Things (Latour, 1993), where hybrids and material objects are the central topic for political discussion, conflict and compromise (Blok & Jensen, 2009; Latour, 2005).

While this is in line with the idea of Participatory Design as a political and democratic process where knowledge is translated through interactions and negotiations with different actors around objects (e.g. prototypes), the authors of the book *Design Things* (Binder et al., 2011) are not fully convinced by the opposition they say Latour has proposed between complex *things* and simple objects. Instead they see design as characterised by the 'opposition between two distinct and distant dichotomies, namely, the new *thing* design creates and the object through which the latter is created'. And they go on to investigate how objects are not only entities of a predefined scope whereas *things* make them public and up for discussion and negotiation. According to the authors, objects can enable interactions by being constituents (artifacts and representations) of the object of design, and in return the interactions are transforming the objects: *'Social experience and the interactions articulating it continuously transform these objects without cancelling the traces of previous representations...'* (Binder et al., 2011, p. 56). I appreciate the idea of encouraging discussions about matters of concern, and at the same time agree, that the objects representing these influence the discussions and negotiations while at the same being subject to influence and change themselves as a result of these.

At a design conference, Latour engages with the world of designers by challenging them, to map and 'draw' or illustrate controversies, to consider design problems as matters of concern, and to focus on designing *things*: *'How can we draw together matters of concern so as to offer to political disputes an overview, or at least a view, of the difficulties that will entangle us every time we must modify the practical details of our material existence?'* And he goes on: *'In its long history, design practice has done a marvellous job of inventing the practical skills for drawing objects, from architectural drawing, mechanic blueprints, scale models, prototyping etc. But what has always been missing from those marvellous drawings (designs in the literal sense) are an impression of the controversies and the many contradicting stake holders that are born within with these'* (Latour, 2008, p. 12).

Some of the scholars from Participatory Design take up Latour's challenge, while promoting democratization. Ehn, Hillgren and Björgvinsson (Björgvinsson et al., 2012) argue, that a way to design things is to do design experiments publicly to open up the discussions. But while ideas of setting up democratic design experiments (Binder et al., 2015) comes across as sympathetic, it seems to relate to a different setting than the proprietary setting of health care companies and organisations that I am looking into in this particular project, which is a setting traditionally being seen as less public.

SOLUTIONS AS NETWORKS RATHER THAN OBJECTS

I am, like my peers, also interested in Latour's challenge and perspectives, as it provides inspiration as to how ANT might be used prospectively in terms of challenging the idea that the object of design is an object or a *thing*. Storni propose an ontological turn in ANT, which entails designing actor-networks rather than only designing objects. He suggest to instead begin *'designing a multitude of elements to build an actor network of H and NH actors that mutually define and reinforce each other'* (Storni, 2015, p. 170), making the object of design a network rather than a thing.

As introduced in the Design-section of the library, the word 'design' can be used to refer to a process as well as to an object or result of the design process. And I, in line with Storni, argue that the same can be said for networks. Traditionally in ANT, *designing* is seen as a process of network-building by rounding up allies: *'Innovation is the art of interesting an increasing number of allies who will make you stronger and stronger'* (Akrich et al., 2002, p. 205). The actors are to be interested and eventually translated in supporting and potentially playing a part in the network of the final solution which also needs to be designed: *In this sense you do not design 'A' product or 'A' solution to 'A' problem: as an engineer of the heterogeneous, you rather design actor-networks* (Storni et al. 2012, p. 12). Hence I argue, that both design and networks can be seen as a *process* and a *solution* which takes a starting point in a hypothesis tested in the problematization phase of translation which designers might call a design brief (see Figure 7):

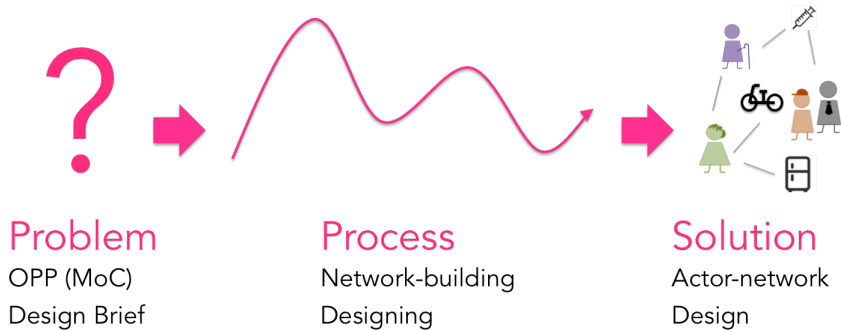


Figure 7: Problem, Process and solution in ANT and Participatory Design terms

Both the term problematization and design brief in a Participatory Design setting refers to the beginning of a project in the form of a hypothesis or OPP to be negotiated. As promoted by Participatory Design, a solution to a problem, or the Object of Design, cannot be identified from the beginning, but is instead negotiated and evolves during the design process eventually resulting in a solution (Binder et al., 2011). Drawing from Latour and the later ANT provides sensitivity towards the negotiations taking place in Parliaments of Things, to see whether the OPP is in fact a matter of concern (MoC) to the actors involved.

And negotiating MoCs is a way to translate knowledge and allies to support the final solution. Drawing from the Participatory Design, Boundary Object and Prototyping literature I will now direct my attention towards physical representations (of MoCs, ideas and knowledge in general) and their role in translation of knowledge between different actors in the design process. These representations are examples of what Binder and his colleagues would term constituents (Binder et al., 2011) as they are representations of the objects of design.

PROTOTYPES AS BOUNDARY OBJECTS

While Participatory Design provides an operationalised approach to gathering new knowledge and insights by interacting with many different actors during the design process using different kinds of materiality for negotiating the knowledge in a political process of mutual learning, ANT provides a framework for talking about how knowledge is translated and negotiated using intersement devices, who should be invited to

participate in these negotiations, and about what comes out of these in terms of knowledge and network-building. ANT and Participatory Design attribute pronounced value to the materiality as a key element for translation of knowledge. And due to the significant role of mock-ups and prototypes for mutual learning in Participatory Design, I will now look more into the role of prototypes in translation of knowledge.

BOUNDARY OBJECT THEORY

Prototypes are said to work as powerful boundary objects between actors from diverse backgrounds, professions and cultures to allow communication and coordination. Boundary Object theory is presented by Star and Griesemer (Star & Griesemer, 1989) who defines Boundary Objects as: *'objects which are both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites'* (Star & Griesemer, 1989, p. 393).

Boundary Object theory was hard to place in my library as it was originally inspired by the sociology of translation (Callon, 1986) linking it to the ANT side, while design scholars from many different traditions have found use of this particular theory, see e.g. (Blanco & Boujut, 2003; Boer & Donovan, 2012; Brandt et al., 2008; Brandt, 2007; Henderson, 1991; Pascal & Thomas, 2007; Rhinow et al., 2012; Subrahmanian et al., 2003) making it obvious at the PD side of the library. However, as it originally draws from the sociology of translation, I have placed it right next to the shelves of ANT-texts.

Boundary Object theory combines the ideas from Latour and Callon with the concept of social worlds developed by Anslem Strauss (Strauss, 1978) as part of Symbolic Interactionism belonging to the American pragmatists tradition. It has the ability to provide insights to the role of mock-ups and prototypes in the interactions and engagements between actors from different 'social worlds'. But in contrast to the traditional ANT tradition, Star highlights the ability of Boundary Objects to coordinate design efforts rather than creating consensus or alignment (Star & Griesemer, 1989; Star, 2010). In line with the work of Strauss and Star, but focusing on coordination and negotiation within organisations, some pragmatists are concerned about sharing knowledge in a business context. For instance Carlile has focused on translation and transformation of knowledge between company divisions and internally in projects teams focusing on how Boundary Ob-

jects play a role in this endeavour (Carlile, 2002, 2004). His work on knowledge transformation share traits from Callon's concept of translation (Soliman, 2013). Carlile highlights the *transformative* nature of a boundary object, by illustrating how transformation of knowledge is the most important aspect in novel and cross-disciplinary situations, which characterises participatory design and innovation activities: *'Objects, models and maps [such as prototypes] are the only category of boundary object that directly supports transforming knowledge'* (Carlile, 2002, p. 452). When involving many different actors in a participatory design processes, knowledge sharing and mutual learning is essential and immediately calls for 'boundary spanning activities' (Carlile, 2002, 2004; Kimble et al., 2010; Lee, 2005; Vinck & Trompette, 2009). Therefore many designers see prototypes as communication agents: *'We are focusing on the prototype as communication agent and medium of knowledge'* (Rhinow et al., 2013, p. 3) (see also: Blomkvist and Holmlid 2011; Carlile 2004; Lee 2005; Rhinow, Köppen, and Meinel 2012; Star and Griesemer 1989). While the Boundary Object literature describes the role of prototypes as boundary objects and communication agents, the prototype literature provides more insights into what prototypes and prototyping are.

PROTOTYPES

Designers, engineers and software developers have a history of representing ideas using visual representations and embodiments such as mock-ups and prototypes (Blomkvist & Holmlid, 2011; Houde & Hill, 1997; Rhinow et al., 2012, 2013). And in both engineering and software development, prototypes has been used to share knowledge across different actors e.g. within project teams, between users and designers and between e.g. company departments (Henderson, 1991; Rhinow et al., 2013; Schrage, 2006). Coming from an engineering design tradition, I was originally introduced to the concept of prototypes as 'first of a type', which made sense in terms of manufacturing the first of a type preparing it for mass production (Floyd, 1984; Sanders, 2013). However, for this dissertation, I use the term prototype in line with the frameworks provided by software-developers who focus on *prototyping* highlighting the process aspects (Floyd, 1984). Prototyping is described as a learning process where the prototypes are the vehicles for learning. Participatory Design originally focused on IT, and has hence developed and evolved along the same lines as software development. And even though the methods from Participatory Design today are being used in a variety of contexts (see e.g. Björgvinsson et al., 2010;

Hussain et al., 2012), mock-ups and prototypes still play a profound role in learning and dialogue between different actors (Brandt, 2007; Buur & Matthews, 2008; Kensing & Blomberg, 1998; Kensing et al., 1998). Also the co-design community has focused on prototypes and their roles in design, and Brandt, Binder and Sanders reflect on how probes, toolkits and prototypes can foster making, telling and enacting when co-designing with non-users, as prototypes provide a means for them to participate as co-designers (Brandt et al., 2012; Sanders & Stappers, 2014) – which shares the values of mutual learning from Participatory Design. Focusing on the ability of the prototype to enable knowledge sharing and mutual learning, the prototype literature highlights the qualities of the prototypes while in the process somewhat neglecting other aspects that might influence knowledge sharing using a prototype as boundary object, such as the facilitation of the prototypes.

THE ROLE OF THE DESIGNER

According to Storni, one way of designing actor-networks is by circulating maps illustrating stakeholders' concerns and agendas to make these 'controversies' public and allowing different actors to comment on these. As I read Storni, these maps might be seen as prototypes or boundary objects for mutual learning in the engagement with various actors, but seeing the designer as a mere map-circulator somehow undervalues the role of the designer. What lies in the role of the designer is also to create these material representations of knowledge, controversies and ideas and bring them to play a role in the negotiations with actors. Latour also has a sensitivity towards the ability to create, which he applauds the designers for having '*To assemble is one thing; to represent to the eyes and ears of those assembled what is at stake is another*' (Latour, 2005, p. 8).

Hence while Storni argue that the designer is merely a map circulator (Storni, 2015), I instead advocate, that the designer is a *navigator* who stages, facilitates, and synthesises design interactions (or *things*) involving human actors as well as materiality in the form of prototypes and mock-ups. Navigation is thus the first of my sensitising devices in this summary, which I use to draw attention to certain aspects of knowledge translation.

THE PROTOTYPE NEEDS TO BE NAVIGATED

So how are prototypes made to work as Boundary Objects in design interactions? Objects do not necessarily work as Boundary Objects by themselves. While some designers would argue that e.g. a cultural probe consisting of a blank postcard (Sanders & Stappers, 2014), given the right script or affordance (Latour, 1994), does not need to be explained or facilitated to create interesting insights for designers, I argue, that though maybe interesting and fun, the probe does not necessarily transform knowledge. Building on the famous example by Latour stating that guns do not kill people and people do not kill people – but the relation between these (the person with a gun in his hand) is very likely to kill people (Latour, 1994), ANT scholars might argue, that the prototype would hold no agency by itself, but that the relation between the designer and the prototype is what makes things happen. Drawing from the concept of navigation, which, as advocated in the introduction, entails preparation as well as agile behaviour (revisit Figure 1), I advocate that materiality (e.g. a mock-up or a prototype) needs to be navigated in order to work as boundary objects.

Staging (preparation)

Staging is a central element of navigation referring to the ‘planning’ aspect. From a design perspective, ‘staging’ is used to illustrate how a project or activity is prepared and arranged in terms of objects, sites and narratives (Brodersen et al., 2008). The concept is inspired by the theatre metaphor, where actors are invited onto the stage to frame problems, solutions, events, and enact circumstances and conditions using props such as design games, mock-ups and prototypes (Brandt et al., 2005). Carefully designed props may work as Boundary Objects for the actors to interpret, negotiate and transform in a process of mutual learning. As the participatory design process consists of a number of activities with different actors it is important that the activities are carefully staged to match the specific activity which might be dependent on e.g. the moment in the design process and the capacity of the non-designers. Vulnerable actors such as patients might be engaged differently from, say, the CEO of the hospital. This points to these interactions being local and temporary representations of a specific moment in the overall design process. So while a single theatre stage can be used to enact an entire play, the space metaphor highlights temporality of these interactions.

The ANT metaphor of ‘networks’ has difficulties handling this temporality, which is why I introduce the space-metaphor to describe how temporary design interactions are staged.

Spaces

The network-metaphor promoted by traditional ANT scholars where networks are always in the making, makes it difficult to talk about defined, temporary networks at a specific moment in time (Clausen & Gunn, 2015; Lindström & Ståhl, 2015). To illustrate the dynamics of political and/or socio-material aspects related to design and innovation processes, authors from the STS and the design community have suggested a range of metaphors for networks (Clausen & Gunn, 2015). Examples of such metaphors are socio-technical spaces and Design:Labs (Binder & Brandt, 2008; Clausen & Yoshinaka, 2007). Clausen and Gunn introduces the notion of Temporary Spaces of innovation in a business setting arguing that *‘Innovation increasingly involves movements through and across a number of temporary spaces that include actors outside R&D departments, including from other areas of corporate life, various companies in a supply chain, design aspects of everyday life and use practices’* (Clausen & Gunn, 2015, 75). This corresponds quite well to Participatory Design practice where actors (internal and external) who are to engage with a solution are invited to take part in designing it at certain moments in the design process. Hence spaces also draw attention to the political aspects of design – because who are invited to participate in the spaces and who are not? Thus the concept of spaces comes in handy, as it allows for discussions about configuration of such spaces. And while spaces might be staged with actors, props, scripts etc. it is equally important that someone is in charge of the interactions taking place on the stage. In a participatory design context this can be seen as facilitation or agility.

Agile Facilitation

The second aspect of navigation is facilitating. While staging refers to the preparation and arrangement of design interactions and processes, facilitation can be seen as referring to the agile behaviour of the designer in making things happen.

Often, the phrase ‘thinking on your feet’ is used to describe an element of agility used in many professions – particularly in design. Agility is related to reflection in action (Schön, 1992), where you draw on previous experience

and modify your actions to the challenges you face in the current situation. Schön advocates feedback loops of experience, learning and practice, where the professional adapts to the situation based on previous experiences and new learning from the situation. When involving different actors in design, the role of the designer is often to facilitate a workshop or an interaction between diverse actors negotiating matters of concern for a specific purpose. He needs to bring actors, props and scripts into play to spark negotiations and discussions that lead to translation of knowledge. For this facilitation to be successful, the designer needs to be agile and adapt to the situation at hand that more often than not do not work out exactly as planned.

In some branches of Participatory Design, the role of the designer is said to be a somewhat neutral facilitator who has no real stake in the interaction being facilitated. However, scholars such as (Buur & Larsen, 2010; Gardien et al., 2014) attributes agency to the designer, and Light and Akama (2012) describes how a bad facilitator is most often a facilitator who has no stake in the interactions, leaving the participants without a clear direction or purpose of the interaction.

NAVIGATION ENTAILS STAGING AND FACILITATION

So from the ANT and Participatory Design literature, we learn about the importance of using Boundary Objects as interessement devices for translating knowledge and mutual learning in a process of interesting actors in design processes. Navigation seems to be an important aspect of making mock-ups and prototypes work as Boundary Objects or Interessement Devices as they need to be staged and facilitated to afford network-building and translation of knowledge. Furthermore, not only interactions but also the entire design process is to be staged and facilitated. If a design interaction is seen as a space, the entire design process must inevitable consist of a number of spaces. According to Brandt: *'...designing the design process itself is just as important as designing the artefact'* (Brandt, 2006, p. 57), which highlights the idea that not only activities (or temporary spaces) must be navigated, also the entire design process is to be navigated to be cohesive and ensure continuity and progress.

This concludes the tour of my ship-library, which to me contains a lot of interesting material. Looking through the shelves, it seems as if Participatory Design can describe some operationalized elements of how the designer navigates (stages and facilitate interactions) to engage many different actors in the design process, while ANT contribute by illustrating how knowledge is constructed through a process of translation and network-building. Furthermore it seems that materiality in the form of mock-ups and prototypes are essential for translation of knowledge and mutual learning due to their ability to work as boundary objects and interessement devices. With this in mind I fetch my compass and eagerly start setting a course towards the land of Healthcare.

CHAPTER 4. EXPLORING THE PUBLIC-PRIVATE INNOVATION ISLAND (THE PPI ISLAND)

STARTING THE JOURNEY

To fulfil my mission I said my goodbyes and set ashore into the unknown. With my compass pointing towards design projects involving numerous actors in the diverse land of Healthcare I sat a course based on my experience as a designer and knowledge of the nation before me and looked for interesting islands to explore.

When not consulting my compass and scouting for landmarks, I was reading logbooks on design projects related to the healthcare sector for inspiration and background knowledge. Due to the focus on PPIs as vehicles for design and innovation of the Danish healthcare sector more than 255 pilot projects have been initiated, which meant that there was a lot of documentation available in logbooks for me to read. Furthermore, to share knowledge and experience from the efforts of attempted collaboration of public and private actors, numerous seminars and matchmaking events was arranged. And I visited many different small islands representing seminars; workshops etc. on PPIs to get in contact with practitioners, and learn challenges and experiences with collaborating across the public and private divide. Interestingly this project setup encouraged a rather new way of directly involving users (the private entities) in design projects as an active part of the design team. This was of great value for the public actors, as they would have a large say in the process. It was also an advantage for the companies who often complained that it was difficult to get in contact with the public entities.

From these logbooks I learned, that private companies are eager to provide new solutions and equipment to this sector. However, public tenders are regulated by the European Union to prevent monopolism and to ensure competitive prices meaning that companies, collaborating with e.g. public hospitals, become ineligible to participate in a following tender. The logbooks contained interesting insights and many of them addressed the challenges of public and private entities collaborating in PPIs (Public Private Innovation projects).

However, the logbooks and seminars drew a picture of two entities that are not used to working within the same timeframes and who do not speak the same language as they come from very different worlds. The companies wanted to engage in pilot projects to develop new products and services to be tested in these smaller projects before scaling up nationwide or worldwide. The public entities were more concerned with developing a new solution that would fit their specific desires in terms of helping them in their daily work practices and give them pride and ownership. And the end-users (though often not represented in the project teams) would, if the project were to be successful, also feel that they have been taken into account in terms of their desires for a new solution. In spite of the many failed PPI projects, one project kept being mentioned as an example of a successful PPI project. This was the sensory delivery rooms project at Hillerød Hospital. Philips was one of the project partners, and as I was interested in collaborating with Philips, I took the opportunity to visit the island of the sensory delivery rooms project when given. This island was called the PPI Island, and as I sailed towards it, I saw the outline of a small island filled with bright lights shining in many different colours, and with music and sounds that seemed to promise a spectacular scenery of waterfalls, beaches and many exotic birds.

LOG BOOK

EXPLORING THE ISLAND

Once I had anchored my ship, I went ashore and was welcomed by; a designer from the small design company focusing on lights and sounds, Wavecare, a midwife with a baby in her arms, and a lighting engineer from Philips. The midwife had worked at a fairly large hospital on the island for some years, and she wanted to create a more relaxing and comfortable environment and experience for the women giving birth at this particular hospital. Driven by this desire, the midwife had initiated a PPI with a project team consisting of herself, the designer from Wavecare, and the lighting engineer from Philips. Together they had developed a new type of delivery room: the sensory delivery room of the future – which was where all the pretty, colourful lights and exotic music and sounds had come from. Beaming with pride, the three of them announced that this was one of the few successful PPIs in Denmark and gestured me to follow them to see for myself the new delivery rooms up close.



Figure 8: Map of the PPI Island

There was a remarkable difference between the atmospheres in the delivery room with the installation turned on and of. Though the sensory delivery room was impressive, I was even more impressed by the enthusiasm and pride radiating from each of the project partners. After seeing the delivery room, I talked to the designer, the midwife and the lighting engineer one-on-one to learn more about the design process – eager to learn, how this project came to be such a success.

INSIGHTS LEARNED

The midwives, who are also the main users of the new rooms as they work in the delivery rooms many hours each week, initiated the process and provide the Obligatory Passage Point (OPP) of the project, which is to design relaxing delivery rooms supporting the midwives in their job, while at the same time providing a nice experience for the woman giving birth as well as her relatives/entourage.

TRANSLATION OF ACTORS TO BECOME ALLIES

While the midwives initiated the process and brought forward the initial OPP, the person who navigated the design process was the designer from Wavecare. He had experience designing new solutions and was eager to develop a successful solution, as it would boost the reputation of his small company and be a good reference for future projects. He had a vision of using lighting, sound and a luminous textile screen invented by Philips to bring nature into the otherwise white, cold and clinical delivery room. A key innovate element was the idea of showing nature-inspired movies on the low-resolution textile screens to set a scene for relaxation. And as the designer brought concrete ideas and visions to the scene, he ended up staging the design interactions with props in the form of mock-ups and prototypes to interest the midwives and Philips in the process. By bringing his ideas represented by mock-ups and prototypes to the stage, he made them the centre of the discussion at the meetings thereby succeeding in modifying the OPP to being: designing new relaxing and flexible sensory delivery rooms using luminous textile and lighting. This interpretation automatically assigned Philips a role as suppliers of the final solution, as they are the only ones who can deliver the hardware to this installation. And with the prospects of being able to sell some of their new screens they strongly support this adaptation of the OPP. In the beginning of the project the designer uses computer mock-ups to represent his modified OPP by showing the rest of the project team illustrations of how the sensory delivery rooms would or could look like with the installation in place. By bringing the mock-ups to the 'stage' he tried to make them work as an interestment device to interest, enrol and mobilise the midwives and Philips to support this vision. At the same time, the prototypes worked as a boundary object for mutual learning, as the designer from Wavecare was eager to hear about the practices and desires of the midwives which was unfolded in their comments and feedback on the mock-ups. Based on these inputs the designer went back to his design studio and synthesised the insights and knowledge produced at the project meeting into a new and higher fidelity 1:1 prototype of the luminous textile. This time he did not only attempt to interest the other team members, his challenge was also to interest another important actor as an ally in the design process: the luminous textile. Presented with the first working prototype of the luminous textile screen, the midwives were hugely disappointed as they found it impossible to see what the screen illustrated due to the extremely low resolution. This threatened to eliminate the modified version of the OPP and stop the interestment of the mid-

wives. Hence the designer went back to his studio to navigate and manipulate the textile by filming new video sequences better suited for this type of screen, and after these modifications the midwives were impressed and hence continued to be interested in the process. This also meant that the modified OPP was still acceptable, and Philips and Wavecare could begin installing a working prototype of the entire installation in a delivery room at the hospital. This prototype was also further modified based on feedback from the midwives (e.g. the ocean waves illustrated on the screen have a too fast frequency in order to accommodate the breathing of a woman giving birth), meaning that the designer once again had to go back and record new video clips.

The midwives ran a small qualitative and quantitative study to learn about the success of the installation, and as it turns out, all the users of the sensory delivery rooms (the midwives, the women giving birth and their loved ones) are extremely satisfied with the result. Even though the women giving birth was not part of the actual design process, the overwhelming good results indicate that the midwives have been good representatives of their desires and their situation. The evaluation report showcasing the results of the study was eventually used as a boundary object for communicating the results to other audiences such as hospital managements. Also the midwives intended to use the report for promoting themselves in terms of attracting new qualified personnel to the department, Philips can use it as an interestment device for interesting decision makers to buy the installation that involved their hardware, and would use it as a reference of a successful design project that might bring them other opportunities to develop other solutions for the healthcare sector.

The negotiations that had taken place during the design process led to a shared understanding among the project team members, that the future is to design not only delivery rooms – but sensory delivery rooms. Except how does actors who has not been part of the project and the discussions and negotiations see this? There has been a huge interest in getting these new sensory delivery rooms from actors in Denmark and worldwide, and a lot of this interest can be attributed to the engagement of the midwives in promoting the project. Their pride and ownership of the result clearly illustrates that they have been mobilised as allies in prototyping a new 'era' of sensory delivery rooms. Ownership is invaluable, and it is on several occasions mentioned (e.g. by the former CEO of Philips Healthcare in Denmark, Ulrik

Rokkedal Therkildsen) as being one of the main barriers going from pilot to full scale. Chinese hospitals are interested in the solution, but instead of buying sensory delivery rooms as the ones at Hillerød Hospital, they want a modified version; A version that fits their particular needs and desires. As a response to this, Wavecare has engaged in a new development process with actors in China, to make a customised sensory deliver room. And even though the sensory delivery rooms is not entirely the same, Wavecare still has a lot of essential knowledge about how to navigate design processes, and what might be important for the hospital staff and the women given birth based on experiences from the Danish project. And they can draw upon this knowledge and build on it in future projects. Please refer to article 1 for more information (Pedersen, 2015).

Filled up with new insights and experiences from my visit to this colourful island, I say my farewells and return towards the beach, where my ship is anchored up. As I return to the familiar surroundings of my cabin, I start to reflect on what I have learned during my visit at the PPI-island.

DISCUSSION

NEGOTIATION AND RE-INTERPRETATION OF OPP

There are many interesting elements in this case. First and foremost, the midwives who are the project owners and main users are central actors in the design project and the design team. They do not have a specific solution in mind that they want to implement. Rather they provide a somewhat structured Obligatory Passage Point (OPP) being that a relaxing sensory delivery room will support them in their work and provide a calming experience for the women giving birth. Interestingly, this OPP seems to be a matter of concern (MoC) (Latour, 2004) to the midwives which they allow to be up for negotiation. Hence instead of the actors either supporting or rejecting the OPP, they are invited and encouraged to adapt, change and modify these through negotiation. The designer from Wavecare takes up this invitation and manages to stage and facilitate the interactions using mock-ups and prototypes that represent what is an MoC to him, which is bringing in nature and using colours and the luminous textile screen to evoke the calmness desired by the midwives. His ability to 'master' the prototypes in terms of building them, bringing them to the stage and facilitating the dialogue as well as synthesising the insights from the project meetings into a

new version enables him to promote the new OPP and translate the midwives and Philips as allies in the process. This more concrete version of the OPP is negotiated and eventually accepted by the allies because it delegates a specific role to every involved actor that they are happy to play. The designer from Wavecare gets to fulfil his vision, the midwives get a flexible and relaxing delivery room supporting them in their work with women giving birth, and Philips gets to sell their hardware. Hence it seems that in contrast to the traditional ANT idea of one actor seeing his idea or solution as an OPP that he or she wishes to promote, instead the collective process of conducting Participatory Design means that the OPP is open for negotiations based on multiple actors and their motivations and interpretation. And the OPP might be modified based on these negotiations to make sure that it represents a MoC for the involved actors. If so, it becomes easier to interest, enrol and mobilise the actors and translate the idea of the normal delivery room into an ambition of developing sensory delivery rooms in the future.

The prototype is the representation of the MoC and consequently the starting point and centre of the negotiations and translation of knowledge through mutual learning. Hence I will look more into the role of prototypes to transform and translate knowledge.

THE ROLE OF PROTOTYPES

One of the foundations of Participatory Design is to involve actors in order to create ownership and share knowledge through a process of mutual learning between the designer and the other actors, making both parties feel that they are gaining from the interaction. The designer gets knowledge about the lives, wishes and motivations of the actors as well as inputs for the final solution, while the actor gains knowledge about possible future technologies and solutions, all the while being empowered by being able to adapt, modify or propose new solutions. This process of mutual learning is in a Participatory Design context related to designers using different prototypes as boundary objects when engaging in dialogue with actors from different 'worlds', e.g. the users. But while Participatory Design has embraced the concept of boundary objects to describe the role of mock-ups and prototypes it does not necessarily describe how these should be navigated in order to enable knowledge sharing and mutual learning. The prototype literature provides contributions in terms of the qualities and properties of mock-ups and prototypes (see e.g. Beaudouin-Lafon &

Mackay, 2003; Blomkvist & Holmlid, 2011; Houde & Hill, 1997; Rhinow et al., 2012; Subrahmanian et al., 2003; Walker et al., 2002) and what might influence their success as boundary spanners. However, the literature does not deliver descriptions on how these are used or how they perform in specific interactions and what happens to the knowledge that comes out of the interactions. From an engineering design perspective Henderson shed some light on the performativity of drawings, and introduce the concept of Conscription Devices as a special type of Boundary Object consisting of engineering drawings *'that socially organize the workers, the work process, and the concepts'* (Henderson 1991, 452) in the project team. And though ANT does not deliver the more subtle operational practices, it might provide a perspective on how these boundary objects create connections between actors in design interactions by seeing prototypes as intersement devices developed by the designer in his or her strives to build networks. ANT inspired scholars from the engineering design tradition such as Blanco, Boujut, Vinck and Jeantet deals with what happens to the knowledge generated in interactions and network-building and propose the terms intermediary objects (Blanco & Boujut, 2003; Vinck & Jeantet, 1995) to highlight how seeing objects as mediators translating and representing the future product can contribute to knowledge-in-action (Blanco & Boujut, 2003). And Bogers and Horst (2014) address how collaborative prototyping creates a prototype-driven approach to problem solving focusing in interactions around prototypes. However, focusing on the sketches as visualisations, they tackle the immediate interaction between members of a project team in an organisation and their ability to represent, mediate and translate knowledge, but do not necessarily address the framing and facilitation of these interactions. Hence, I find a need for a concept, which binds these elements together focusing on the navigation (staging and facilitation) of interactions as well as entire design processes. Hence I introduce the concept of temporary Prototyping Spaces, to highlight the central role prototypes play when navigated in design interactions of knowledge sharing and mutual learning.

INTRODUCING PROTOTYPING SPACES

In the presentation of my ship library, I have already introduced the concept of spaces, which can be seen as a metaphor for networks. In contrast to the concept of networks that are always in the making, spaces are temporary and take place at a certain moment in time. Furthermore spaces can be said to have a certain configuration meaning that some elements (e.g. actors and objects) are invited inside the space while others are not. Especially the concept of temporary spaces of innovation proposed by Clausen and Gunn (Clausen & Gunn, 2015) is interesting as I see how it can help describe participatory design interactions with different stakeholders during the design process. However, due to the importance of materiality in design to work as a boundary object representing matters of concern and sharing knowledge in Participatory Design, I will be calling these special spaces for temporary 'Prototyping Spaces'. Each of the project-team meetings can be seen as navigated temporary Prototyping Spaces, with the following configuring elements: The designer from Wavecare, the midwife (also representing the pregnant women), the lighting engineer from Philips, and a sort of mock-up or prototype here represented by a computer-based mock-up of the installation (see Figure 9).

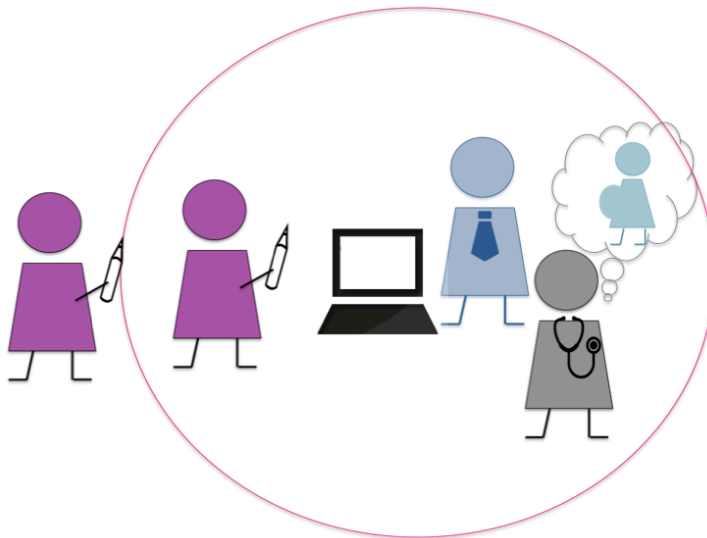


Figure 9: The designer is staging (configuring) and facilitating the space

By being special I mean that the spaces I can identify based on the experiences at the PPI Island are not 'just' interactions. They represent a special type of *navigated* interaction meaning that 1) certain actors have been invited to the space as part of the staging, 2) the spaces are facilitated to meet specific purposes of mutual learning and interessement through negotiations, and 3) the outcome is synthesised and used as input to the prototype developed for the next space. Thus it seems as if there is one more element or stage to navigation than staging and facilitation. Also synthesis of the outcomes of staging and facilitation is part of the navigational moves.

PROTOTYPE OR PROTOTYPING?

Even though I have highlighted the importance of *prototypes* as representations and boundary objects in design activities, I use the term *prototyping* to direct attention towards the process perspective of translation of knowledge. Prototypes are certainly still at the centre of attention in these processes, as the negotiations leading to translation has their starting points in physical representations of e.g. an OPP. Floyd (1984), who comes from the software design tradition, has done important work on prototypes and prototyping. She mentions how there is no 'first of a type' in software design because prototypes are more related to the overall development process, and that: *'prototyping in connection with software development indicates that we are primarily interested in a process rather than in the 'prototype' of a product'* (Floyd, 1984, p. 2). In line with the concept of mutual learning from Participatory Design, Floyd goes on to suggest, that prototyping is a learning process with the prototype as vehicle for learning. According to Floyd the prototyping process consists of four moments: Functional selection, construction, evaluation, and future use. Naturally these aspects are very much related to specific development and testing of prototypes, however I dare to suggest, that aspects of these can also be used more broadly in terms of different types of design interactions by using the concept of navigation. Thus I introduce a framework of 'Navigating Prototyping Spaces' as a sensitising device for analysing translation of knowledge and actors at certain moments in a participatory design process.

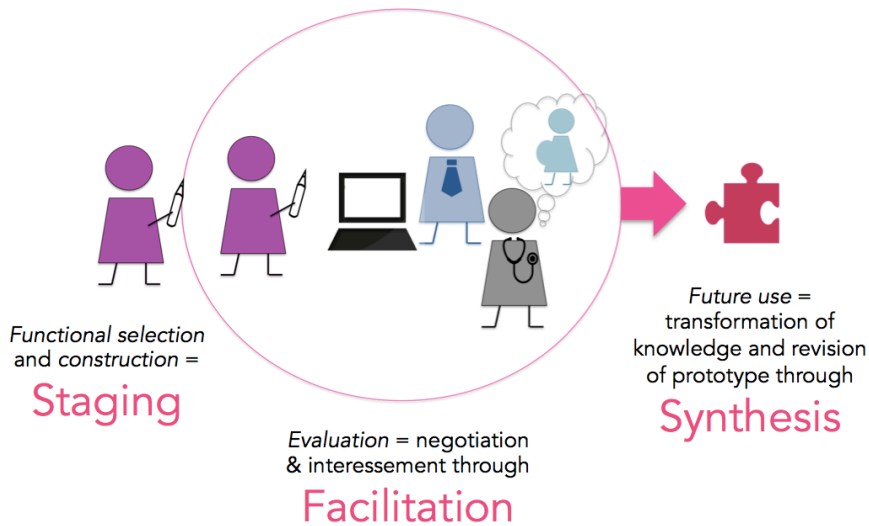


Figure 10: The prototyping process

What Floyd calls functional selection and construction, I claim are only elements of the preparatory activities, which I term Staging. In my view there is indeed more to staging than just functional selection and construction, which only refer to the prototype. The sensitising concept of Navigating Prototyping Spaces provides sensitivity towards the configuration of the entire space, including which actors to invite to the stage and for what purpose. Next we have evaluation, which is part of the facilitation stage in navigation. But instead of focusing on evaluating the prototype, my purpose of introducing Prototyping Spaces and navigation is related to negotiation and intersement of actors where the prototype play the role of being a potential Boundary Object representing the OPP. The outcome of the negotiations and dialogue in the space is translation of knowledge and of the actors involved. Furthermore the translation of knowledge potentially also involves a modification of the OPP and of the prototype representing the OPP. Finally, synthesis can be seen as the future use of the knowledge gained through mutual learning that is synthesised into a new prototype to be used in the next Prototyping Space and/or as part of the network of the final solution.

I have already argued how I see staging and facilitation as central elements of navigation of design interactions, which can be seen as Prototyping

Spaces. And my experiences at the PPI Island, combined with my adaptation of Floyd's moments of the prototyping process, further adds to the sensitising concept of navigation. Interestingly, synthesis of the knowledge gained through mutual learning and interessement, is an important element of the navigation of the entire design process, as synthesising the knowledge becomes a new prototype serving as a fundamental configuring element in the next Prototyping Space.

Hence, my framework of Navigating Prototyping Spaces points to three important 'phases' of the process of translating knowledge using prototypes as Boundary Objects which is: Staging, facilitation and synthesis (see Figure 11).

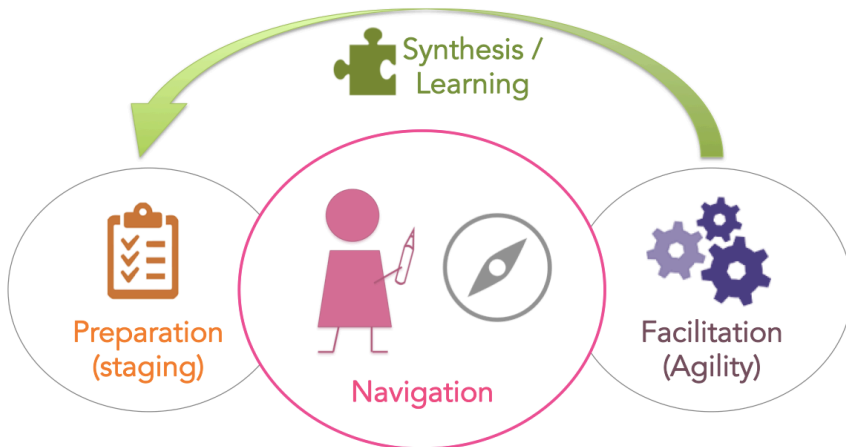


Figure 11: Navigation consists of Staging, Facilitation and Synthesis

NAVIGATING PROTOTYPING SPACES

Navigating Prototyping Spaces entail staging and facilitating the spaces, and synthesising the knowledge gained through the mutual learning and translation of designers and non-designers.

Staging Prototyping Spaces

The designer staged several Prototyping Spaces by preparing and configuring them. He developed mock-ups and prototypes in advance to bring to the spaces to start a negotiation with the other project team members and drive the design process forward by setting the scene for mutual learning around these prototypes meant to work as Boundary Objects. The proto-

types represented his modified version of the OPP, and it seems as if the designer's ability to master or navigate the prototypes played an important part of his version of the OPP gaining momentum.

Facilitating Prototyping Spaces

The designer not only staged but also facilitated the spaces by encouraging dialogue and negotiation with a starting point in his mock-ups and prototypes. He managed to build trust among his project partners, the midwives and Philips, by actually taking the opinions voiced during the negotiations into account in the next version of the prototype. This provided ownership among all project team members and further motivated negotiations.

Synthesising the outcome of the Prototyping Spaces

The designer also navigates the entire design process by translating the knowledge/insights gained from each space into a new representation or prototype to use in the next (see Figure 12).

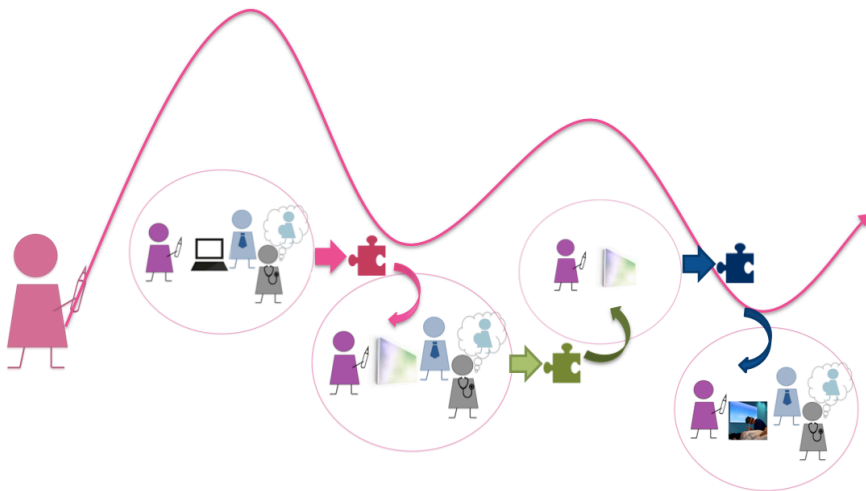


Figure 12: The different Prototyping Spaces in the design process

When the midwives did not approve of the first luminous textile prototype, the designer managed to synthesise and translate the inputs of the midwives into the next iteration of the prototype. This also indicates that there might be more Prototyping Spaces than just the project meetings: Based on the feedback at each meeting, the designer from Wavecare goes back to his design studio and designs new prototypes that represent the OPP

and the knowledge produced as an outcome of each space. Hence, the designer working on ‘interesting’ the new prototypes might also be seen as Prototyping Spaces illustrated by the third space in Figure 12. He brought with him the results of the mutual learning process to use in the next Prototyping Space as well as in the final solution. This way the midwives could physically see their ideas represented in the prototypes and in the final solution, which further amplified their sense of ownership of the project.

Hence it seems that the concepts of navigation and Prototyping Spaces might illustrate how knowledge is navigated and translated throughout the participatory design process. Following the prototypes (representing this knowledge) leads us to learn about the progression of the knowledge produced and shared in the design process. In the illustration above the knowledge is represented by a puzzle piece, and the curved arrow represents the synthesis of this knowledge into the prototype in the next Prototyping Space (see Figure 12), while the design process is illustrated with inspiration from Pugh (1991) and IDEO’s adaptation.

CONTRIBUTIONS

I have introduced the framework of Navigating Prototyping Spaces, which allows me to shed light on elements affecting how knowledge is translated in a participatory design process. Furthermore, it is an attempt to outline the beginning of an operationalized approach of how to navigate these elements. It seems that navigation in terms of staging, facilitation and synthesis of Prototyping Spaces allows me to explain certain aspects of engaging with multiple actors in design processes.

The concept of Prototyping Spaces offer sensitivity towards design as a step-wise process of iterative moves related to staging, facilitation and synthesis which eventually ends up with a solution based on the knowledge translated during the design process. Introducing navigation and Prototyping Spaces allows me to explain how OPP in a Participatory Design setting can be seen as a matter of concern to be negotiated rather than as a solution more or less given in advance. In this way I add to Callon’s translation framework by drawing attention to a collectively negotiated OPP modified based on inputs from the project team members.

Thus while Blanco, Boujut, Vinck and Jeantet (Blanco & Boujut, 2003; Vinck & Jeantet, 1995) as well as Bogers and Horst (2014) speak of intermediary objects focusing on direct interactions centred around prototypes, the idea of navigating Prototyping Spaces allows me to take on a broader perspective and address how knowledge is negotiated and translated from one space to the next. Furthermore, it provides sensitivity towards translation of certain actors invited to participate in the spaces in order to encourage pride and ownership of the process and of the final solution.

CHAPTER 5. EXPLORING THE OPEN INNOVATION ISLAND (THE OI ISLAND)

MY NAVIGATIONAL MOVES

After my experiences at the PPI Island, I was filled with new impressions and eager to continue my journey. When my compass stirred and led me towards new and interesting islands, I now had an even better idea of what I was looking for. At the PPI Island, I learned that design interactions are to be staged with people and boundary objects to facilitate mutual learning and translation of knowledge as well as actors. Looking into a PPI consisting of three main actors in a tightly knotted project group was indeed rewarding. However, I now wanted to seek out still more complex design settings involving even more diverse actors. So when I saw the outline of the OI (Open Innovation) Island in the horizon, my heart started to beat faster. I had learned about this island from my partnership with Philips, as they have created this exotic getaway themselves. Open Innovation is related to design management in larger companies and involves both internal and external stakeholders, which was just the level of complexity I was looking for. This time, I decided to explore the life on the island in even more depth in order to get more detailed empirical material and experiences. Instead of just speaking to the inhabitants, I wanted to be a part of them to better understand their navigational decisions during the design process.

LOG BOOK

EXPLORING THE ISLAND

I was warmly welcomed and the Philips design team appreciated my enthusiasm and ability to contribute to the currently on-going design project at Philips Research centred on improving the lives of stroke-patients. My role was to conduct user-research with stroke patients and hospital staff at two hospitals in Denmark, to share my synthesised insights with the project team, and collectively translate the combined insights into a future concept together with two designers.

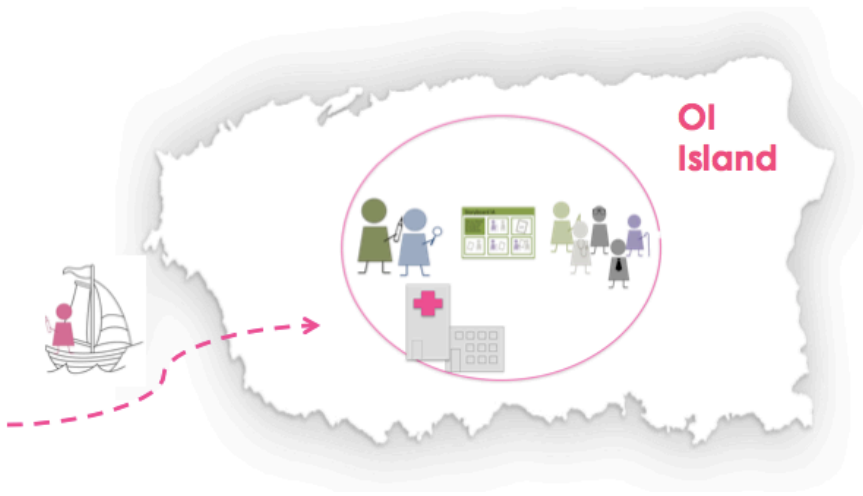


Figure 13: My journey to the OI Island

INSIGHTS LEARNED

This story originally starts with the head of the Research Department in Philips asking a project manager to gather a team of researchers and designers to focus on, and develop business ideas, that would help stroke-patients in their recovery while still admitted to the hospital. Based on dialogue and engagement with neuro-scientists and doctors from hospitals in the Netherlands and in Belgium, the project team brought forward the OPP that Patients recovering from a stroke are happy to get visits from loved ones but also quickly tire from these visits due to their condition and finds it difficult to communicate this to their loved ones. The design team initially set out to test if the OPP was also a matter of concern for the patients by exploring 8 different ideas represented by storyboards illustrating how different setups of neurologists, doctors, nurses, physiotherapists, patients, relatives, lights, sounds, apps etc. would indicate that it was time to end the visit. These ideas, and the storyboards representing these, were generated by Philips' staffs based on the insights gained from the interactions with the neurologists etc. at the hospitals. Developing the ideas and storyboards and selecting different actor-groups with whom to engage, (the same actors represented in the storyboards) was part of the configuration of a number of Prototyping Spaces to take place at hospitals in Denmark and the Netherlands.

Due to the complex setting involving many diverse actors each contributing with unique motivations, backgrounds and cultures, the members of the project team navigated a number of Prototyping Spaces to learn from these external actors. Each space (like we saw at the PPI Island) includes a designer, a non-designer and a 'prototype' in the form of the storyboards representing the OPP that was staged and facilitated to work as a boundary object. Nevertheless, as the case will illustrate, more configuring elements influences the outcome of the space. The following vignette, also presented in my article (Pedersen, 2016), gives an example of what happened inside one of the initial Prototyping Spaces at a hospital in Denmark. The designer from Philips (in this case, me) navigated the Prototyping Space where a patient, who had recently awoken after a stroke, was invited to share her experiences of being a stroke-patient and comment on the eight storyboards. A designer and a researcher initially staged the overall frame for the space by preparing the storyboards as well as an interview guide, and I staged the spaces locally by finding patients in different settings and facilitated the interactions focusing on the storyboards (see Figure 14):

At 1PM one of the patients awakes from his nap and has agreed to talk to the designer. The designer positions herself on the patient's bedside, and soon the storyboards are scattered all over the duvet. The patient tries to comprehend and separate the different ideas from each other and is struggling to maintain focus as the designer goes through the scenes of all 8 storyboard. During the interaction, the designer frantically tries to catch all the storyboards to prevent them from sliding from the duvet and onto the floor. The patient has difficulties understanding the ideas, and instead pulls a stack of pictures of her house and his family from his bedside table, and enthusiastically starts showing them to the designer. The designer is experienced, and hence does not let this 'setback' prevent her from learning new insights from the patient. Instead she starts asking general questions related to the different aspects of the 8 ideas, and the patient responds by engaging in a dialogue about his current situation, which is what he can manage to relate to at this moment. (Pedersen, 2016)

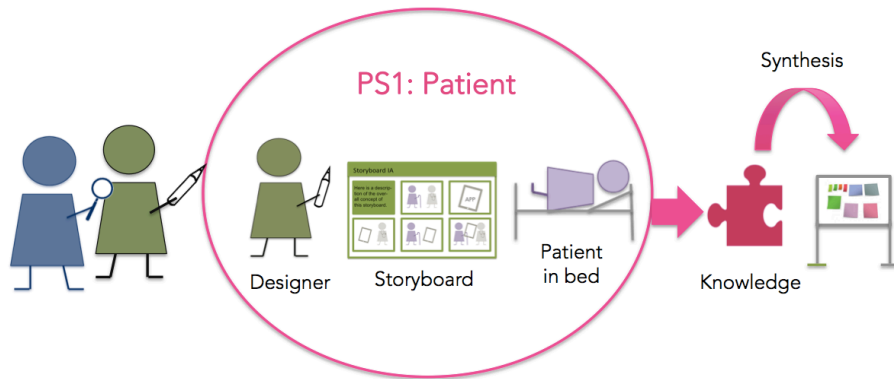


Figure 14: The first Prototyping Space involving patients

Similar to this one, several spaces were staged and facilitated at the hospitals to include and involve around 10 stroke-patients who were active enough to e.g. come to the hall and sit at a chair in front of a table to have an overview of the 8 concepts. In these spaces, the storyboards *did* work as boundary objects, and a lot of new knowledge about the situations and preferences of the patients was produced during the interactions. Many patients indicated visits from relatives spanning from mothers in laws to old cellmates from jail, which they would rather have done without, as a greater source of frustration than ending already on-going visits. Based on these insights, the matter of concern was modified to focus on managing visits in general rather than ending existing ones.

Also, several spaces were staged and facilitated at the hospitals involved doctors, nurses, physiotherapists, occupational therapists etc. again using the prototypes as boundary objects. The knowledge gained from all the interactions with patients as well as hospital staff, was synthesised into a number of thematically arranged quotes, pictures and ranking scores (scores illustrating how the actors ranked the 8 ideas) intended to serve as an element in the following Prototyping Space at Philips headquarters (see Figure 15). In this space, clip-outs of quotes and pictures played the role as boundary objects for mutual learning between the designer and the rest of the project team.

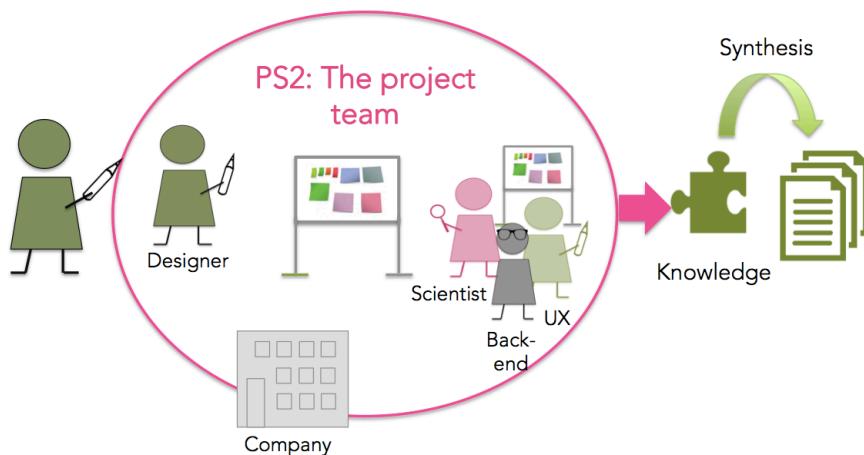


Figure 15: The second Prototyping Space

The knowledge from the second space was synthesised into an updated version of the project URS (user requirements specification) and FRS (functional requirement specification) intended to serve as project documentation and form a basis for the programmers developing the first iteration of the app. Once the functional prototype was developed, the senior project manager took over the role of being in charge of the staging and facilitation of spaces to communicate the functionalities and the contributions of the new app to decision makers within the Philips organisation. He used this nice-looking app as an important configuring element in a space to interest both his superior, potential buyers (such as hospital managements), and Business Unit managers from Philips who was going to include the app in the product portfolio of their particular business unit and sell the app alongside the other products in the portfolio (see Figure 16).

However, as it turned out, the BU-managers was not interested in selling the app, as they could not see, how it could add value and work together with the existing elements of their product portfolio. This put a stop to the design process, which was somewhat of a blow for the design team having spend quite a lot of time and effort on the project. The efforts had not been for nothing though, as the knowledge and ideas generated from this project was used in another project focusing on diagnostics.

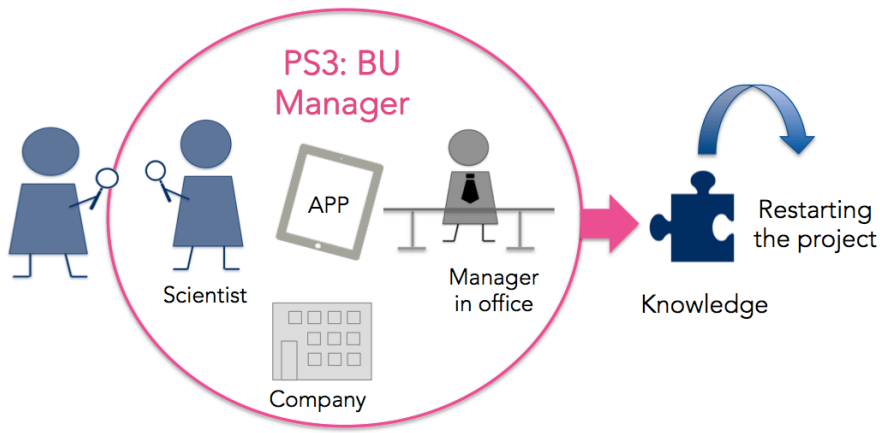


Figure 16: The last Prototyping Space

This time, the design team staged and facilitated Prototyping Spaces with BU-managers already from the beginning of the project. And the outcome of these spaces was, that the BU-managers were eager to promote a new app focusing on cognitive diagnostics and training of recovering stroke-patients, which had been only a sub-element of the initial app. Please refer to article 2 for more information (Pedersen, 2016).

DISCUSSION

NAVIGATING NUMEROUS ACTORS

This case being an Open Innovation project, driven by a large organisation, dramatically increases the complexity in contrast to what we witnessed at the PPI Island. Designers, researchers, programmers and project managers are involved from the project team and neurologists, patients, loved ones, occupational therapists, nurses etc. are examples of external actors involved in the process as well. These actors all contributed to the design process by expressing their desires, motivations and agendas and are invited as central configuring elements of quite a large number of Prototyping Spaces. Other actors such as the BU-managers from the organisation and the head of research who initiated the process were more reluctantly involved in the process. This brings forward a discussion of who is invited to participate in the spaces and at what moment in the design process. Instead of having all actors present at the same time in most of the Prototyping Spaces, in this

case we see a large number of actors are invited into equally many Prototyping Spaces following after each other. Hence, the moment of involvement of the diverse actors becomes important, and the political nature of participatory design becomes evident – because who should be invited first, middle and last? And who is not actually invited but rather forces their opinions through? Once again I will use the sensitising concepts of Prototyping Spaces and navigation to analyse the case and identify aspects for the designer to keep in mind when navigating a participatory design process.

From this case it seems that Prototyping Spaces might involve more configuring elements than a designer, a non-designer and a prototype, as more aspects affect the outcome of the spaces. To identify more configuring elements of the Prototyping Spaces, which the designer needs to take into account when *staging* the Prototyping Spaces, I draw from the prototype literature, which indicates a number of important elements to keep in mind that influence the ability of the prototype to serve as a viable Boundary Object for translating knowledge.

Staging Prototyping Spaces - More configuring elements

According to the prototype literature, four prototype characteristics influence a design interaction: *format* (e.g. storyboards or a working model) (Beaudouin-Lafon & Mackay, 2003; Blomkvist & Holmlid, 2011; Houde & Hill, 1997), *fidelity* (refinement of prototype – from drawings to ready for production) (Blomkvist & Holmlid, 2011; Buskermolen et al., 2015; Rhinow et al., 2012; Sauer et al., 2010; Walker et al., 2002), *purpose* (e.g. exploring, evaluating and communicating), which is a more specified purpose than the overall agenda of mutual learning and translation of actors (see e.g. Blomkvist & Holmlid, 2011), and *moment* in design process (Beaudouin-Lafon & Mackay, 2003; Blomkvist & Holmlid, 2011). As already touched upon, the moment in the design process is important and political in terms of whom to involve at what time. And the moment in the process also influences the three characteristics of format, fidelity and purpose. For instance low fidelity prototypes such as drawings are used to explore ideas in the initial stages of the design process, whereas working 1:1 prototypes made in the right materials are used for communication purposes later in the process.

But aside from the four characteristics provided by the prototype literature, this case also draws our attention towards how the material arrangement of the location can influence the space. The duvet of the hospital bed kept working against the patient gaining an overview of the storyboards, as it kept sending them towards the floor. Not many scholars have commented on the material arrangement of the place where collaborative design efforts takes place. However, Binder and Brandt have used the spatial metaphor of Design:Labs to illustrate the exploratory nature of the design research conducted in workshop settings at the location in which the new design is to be used (Binder & Brandt, 2008). Also other research points towards the differences of being in the real context as opposed to a constructed workshop setting, which might also be influenced by the moment in the design process (Brodersen et al., 2008; Iacucci & Kuutti, 2002; Vaajakallio & Mattelmäki, 2007). When being open and exploratory, a real life context might not be preferable, but when it comes to learning about current practices and meeting actors in their comfortable environment, a real-life setting might be preferred.

So based on the additions in the above, the Prototyping Spaces can be said to have 5 configuring elements: 1) A *facilitator* who facilitates the interaction in the Prototyping Space, 2) the internal or external *actors* to become interested, 3) a *purpose* (e.g. exploring, evaluating or communicating), 4) the assembly of materials and meanings that constitutes the *location*, and 5) an appropriate prototype *format*. So when the design team is navigating a design process and is staging a purposeful design interaction with a desired outcome, they need to discuss and ask themselves the questions illustrated in Figure 17.

I am referring to the design team here rather than the individual designers, as this case indicates, that the actor *staging* the space is not always the same *facilitating* it. Coordination seems crucial, and here is where another useful Boundary Object comes in which could be an interview guide that might be referred to as the manuscript accompanying the 'play' on the stage. Furthermore, the *form* and *fidelity* of the prototype should match the *person to be interested*, the *material arrangement* of the space as well as the *purpose* of the space.

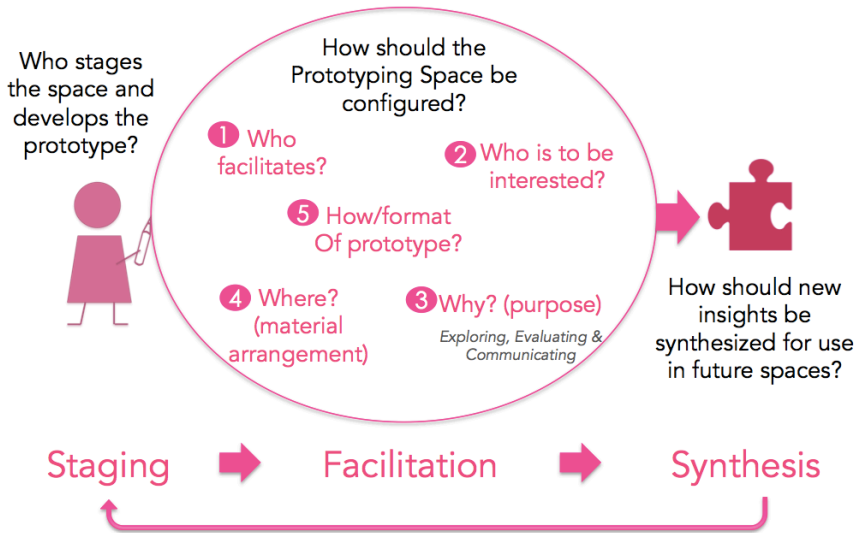


Figure 17: Questions to be discussed in the design team to foster navigation

In the Prototyping Space involving the bed-ridden patient, the storyboards were too long and difficult to understand for the patient being in a fragile stage as well as being too big and bendable to prevent them sliding from the bed. Also the facilitator should be aware of the desired outcome of the space related to the purpose of setting up the space in the first place. The produced knowledge and insights should eventually fit the entire staging of the next space etc. For instance the patients was presented with exploratory prototyping encouraging negotiations of the OPP while the pictures, quotes and ranking scores used in the next space aspire to different actors on the project team. The designers prefer pictures and quotes, while the researchers are more interested in quantitative material such as the ranking scores.

Space-configuration change according to moment in design process

Due to the increase in both actors and time, the configuration of the Prototyping Spaces changes significantly according to the moment in the design process. Prototyping Spaces as a sensitising device highlights the temporality of various design interactions, as well as the change in configurations. In Table 1 we see how the configuring elements of the spaces change according to moment in the design process.

Table 1: Overview of configuring elements according to moment in design process

Configuring Elements	Early (PS1)	Middle (PS2)	Late (PS3)
Purpose	Exploring	Evaluating	Communicating
Format	Storyboard	URS & FRS	App
Fidelity	Low fidelity	Low fidelity	High fidelity
Actor(s)	Patients, doctors, nurses, relatives, etc. (external)	Project Team (Internal)	Manager and BU leaders (Internal)
Navigator(s)	Designer & Scientist	Designer	Project Manager
Facilitator(s)	Designer	Designer	Project Manager
	Interessement	Interessement, enrolment and mobilization	Interessement and enrolment

After having addressed how staging the Prototyping Spaces may include taking the 5 configuring elements into account, I go on to discuss the next aspect of navigation: facilitation. Facilitation is an important aspect, however, it seems as if agile behaviour is even more important dealing with vulnerable actors. Being a part of the design team allowed me to give detailed accounts of the facilitation of Prototyping Spaces with patients recovering from a stroke and being in a very fragile state.

Facilitating Prototyping Spaces with vulnerable actors

The case illustrates the importance of facilitating the Prototyping Spaces, as the configuring elements do not automatically trigger knowledge sharing and mutual learning as part of the staging. They need to be brought into play.

Especially in this case, where some of the actors invited to the Prototyping Spaces were quite fragile, agile facilitation was central. The patient in the

first Prototyping Space was not quite able to follow all the ideas on the storyboards and separate the information from each other. Instead she gave up, and started showing pictures from her everyday life outside the hospital. The designer then used all her navigational skills to ask general questions related to the patient's experiences of being admitted to the hospital to gain knowledge that could still be used in the project. The prototype did not work very well as a boundary object, because there was no real process of mutual learning generated based on the interaction around this prototype. Nor did the patient get interested as an ally supporting the solution. The format of the storyboards was too large and contained too many pictures for the patient to relate to, and it was not appropriate for the material arrangement of the patient room, as it kept sliding from the duvet.

In this situation, the designer shows a great deal of agility in terms of adapting to the situation to get valuable insights out of the interactions despite of the challenging circumstances. Her actions can be described by Schön's reflection in action (Schön, 1984), where the designer mentally goes through the feedback loop of experience, learning and practice proposed by Schön. She draws on previous experience in terms of using the storyboard to engage with patients, and when this does not work, she learns from the current experience and tries something different in practice, which is to speak about more general aspects of being admitted to the hospital and having visits. I would argue that Schön's feedback loops have some of the same qualities as navigating Prototyping Spaces does. But before going into this discussion, let me first address the synthesis stage of navigation.

Synthesising the outcome of Prototyping Spaces

In line with the findings at the PPI Island, also this case illustrates how the outcome of the Prototyping Spaces is synthesised and translated into Boundary Objects to be used in the next spaces (see Figure 18).

However it seems as if there are other outcomes than merely 'prototypes' to be used in the next space. Also other material Boundary Objects used to feed into new versions of the prototypes are at play. For instance the ideas generated at an initial workshop are synthesised and translated into a prototype (the storyboards) representing the OPP used in the next spaces for engaging with the patients. However, the insights learned from the interactions at the hospital are not immediately synthesised and translated into a prototype. Instead they are translated into quotes, pictures and ranking

scores to be used in the next space to work as Boundary Objects as a means for sharing knowledge and mutual learning among the project team members during a workshop at the Philips headquarters. The outcome of this next space is an updated version of the FRS and the URS, which is eventually synthesised and translated into a functional prototype of the app shown to key actors within the organisation.

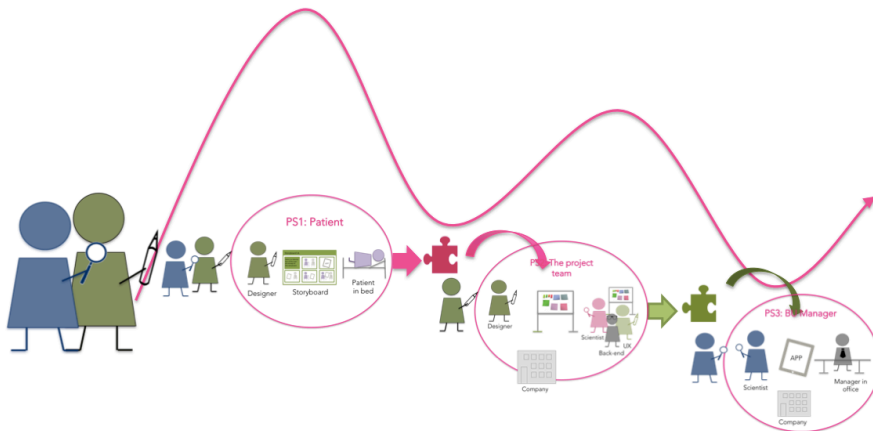


Figure 18: Illustrating how knowledge produced in each space is synthesised and translated as part of staging the next space

These boundary objects being material artifacts and representations are all examples of what Binder et al. term the constituents of the object of design (Binder et al., 2011). The constituents designed through synthesis as certain moments in the design project makes reference to previous, future, and / or future versions of the final solution, while it is being designed. And as such, it also documents the design process while bearing witness of the complex history of design decisions, discussions and negotiations along the way.

The general observation is that the knowledge and insights gained as an outcome of the Prototyping Spaces is translated into 'something' that can be used as Boundary Object in the next space. And importantly, it is not only randomly synthesised into something new, it is carefully synthesised into something that 'speaks to' the actors which are part of the configuration of the new space (for instance by including qualitative and/or qualitative elements or by being simple and easily understandable when dealing with fragile actors).

Even though not all these Boundary Objects are what we would typically term prototypes, I still see how the concept of navigating Prototyping Spaces is relevant in terms of dealing with prototyping – which I have argued is the process that can be said to entail navigation in terms of staging, facilitation and synthesis.

NAVIGATION AS ITERATIVE FEEDBACK LOOPS

The three stages of navigation (staging, facilitation and synthesis) can perhaps similarly to Schön's idea of reflection in action be seen, as a feedback loop of learning and application, as the synthesis of the knowledge, produced in the space and learned by the designer in the process of mutual learning, is a central part of the staging of the next space. Due to the temporal nature of the spaces, knowledge continues to be built and flow iteratively from one space to the next after being synthesised (see Figure 19). But while Schön merely describes these steps related to how individuals and organisations learn, navigating Prototyping Spaces provides a more operationalized concept informing the designer in his or her efforts to involve many actors and translate knowledge in participatory design processes. It does so by breaking down each step of staging, facilitation and synthesis into specific elements to take into account.

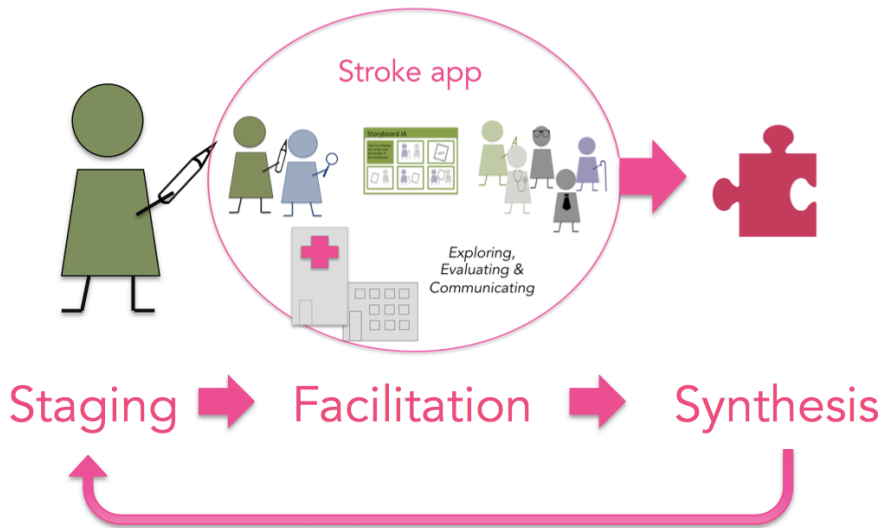


Figure 19: Navigating Prototyping Spaces seen as iterative feedback loop

NAVIGATING PROTOTYPING SPACES TO ENCOURAGE NEGOTIATION OF OPP AND TO TRANSLATE ACTORS

I have claimed, that the idea of involving many different actors in design processes it to get a lot of new knowledge through mutual learning, which can eventually be translated into a solution. However, it seems as if there are more to the story than just producing knowledge that can be synthesised into a final solution. As participatory design is a democratic endeavour, the purpose of the spaces is not only to produce knowledge, but also to encourage negotiation of the OPP and to translate actors as allies to support the network of the final solution. Hence, staging the spaces means configuring the space to support the facilitation of negotiation and translation of the non-designers involved to modify the OPP and become allies in the network. Synthesis also plays a part in the negotiation and translation, as it is important for the actors to be able to recognise their inputs to e.g. the changes in OPP in the final solution, if they are to become allies in supporting it.

Not all actors need to be interested for the network to work, however. The patient who started showing pictures of her relatives was perhaps not interested, let alone enrolled and mobilised as part of the final solution. However, the designer still managed to gain valuable knowledge about her moti-

ventions and aspirations in life, as well as of the mental state of some of the potentially future users of the app. Interestingly, the project team failed to translate one of 'their own', as it was the BU-manager that eventually put an end to the project.

CONTRIBUTIONS

Once again the framework of Navigating Prototyping Spaces allows me to analyse how knowledge is translated – this time in an even more complex setting of many diverse actors with each their own motives, backgrounds, incentives and desires. The framework also provides insights that can be operationalized by focusing on how to stage the Prototyping Space taking a number of configuring elements into account, how to facilitate the Prototyping Spaces showing an agile behaviour, and how to synthesize the outcome and use it to stage and facilitate the next space in iterative loops to promote negotiation the OPP while interesting (and potentially enrolling and mobilising) the non-designers along the way.

This focus on navigation and negotiation further challenges the idea of the single entrepreneur manipulating allies to support his idea or invention. In this case, we see a collective of designers, researchers and project managers interchangeably taking on different roles while taking part in the navigational moves.

Furthermore, the temporality of the Prototyping Spaces clearly illustrates the step-wise and iterative process of designing a solution. Seeing a design process as consisting of a number of successive Prototyping Spaces also draws attention to the moment of involvement in the design process, which illustrates the political nature of design. The BU manager was only involved at the very end of the design process and, although only speculative, perhaps different navigational decisions such as involving him at an earlier stage in the process, rather than ignoring him, might have given a completely different course of events and outcome.

CHAPTER 6. EXPLORING THE PRODUCT-SERVICE SYSTEM ISLAND (THE PSS ISLAND)

BE AWARE OF SEA-MONSTERS!

Sailing away from the OI Island, I was filled with expectation. I had planned, that the next step of my journey was going to lead me to exotic although familiar surroundings. My plan was to sail the ship all the way to Nepal to visit interesting islands and engage with projects involving actors from different levels of society (vulnerable citizens, NGOs, ministries etc.). Previous exploratory journeys had taken me there, e.g. when I designed the improved cooking stove in my Masters Thesis, and hence I already had a lot of contacts with interesting engagements that I planned to visit. However, the big and notorious sea-monster with an octopus-like shape known as 'the Funding-monster', grabbed my entire ship with one of its huge arms, and steered me off course, and in another direction.

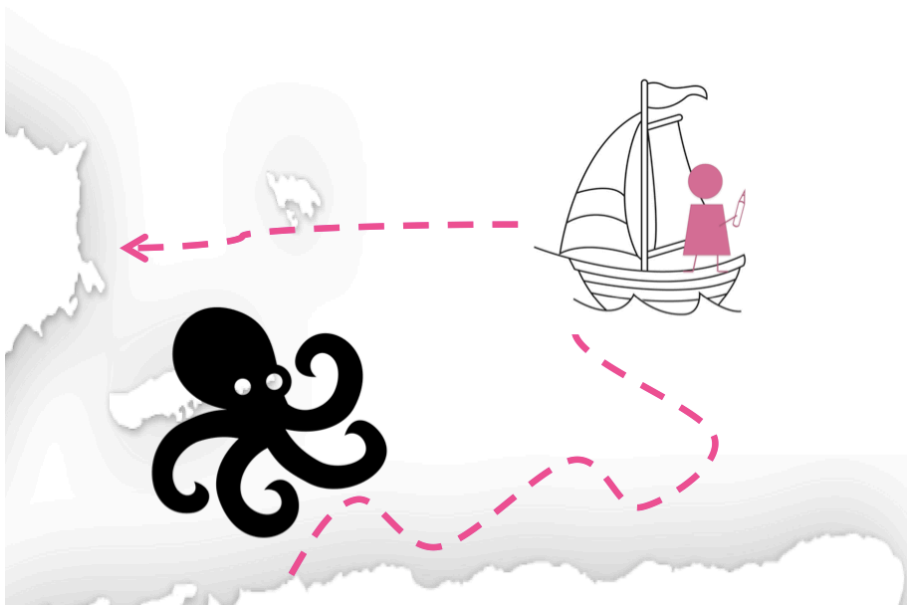


Figure 20: My encounter with the sea monster

After being thrown off course, I had to adapt and rethink my initial plan by set a new course. As I was not able to actually go to Nepal, I instead decided to draw upon the experience and insights from a design project I had already conducted a couple of years ago in India. The benefits of choosing an already finished project were, that I did not have to meet a specific timing, and that I already knew, how the project turned out. Furthermore, being part of the entire process from planning to delivery allows for a unique level of detail about the navigational moves at space as well as process level. And the detailed nature of the empirical material allows me to use this case to follow up on my experiences at the PPI Island and the OI Island. The island I was going to revisit in my memory is called the PSS Island, as the object of design was a product service system (PSS) for bringing insulin closer to the patients in India.

A large Danish pharmaceutical company who has a large market share among the people from the upper-middleclass in India, and now wanted to be able to bring insulin to the poor diabetics of rural India, initiated the design project in question. Hence bringing insulin closer to the patients in India was the original OPP brought forward by the company. This OPP was by the designers treated as a matter of concern to be negotiated and explored together with different actors in India. My recollection of the experiences at the PSS Island was in the beginning a bit foggy. Fortunately I had my old logbooks with me, which helped me remember the circumstances and detailed accounts, in illustrations and text, of the events that took place. This gives an impression of the importance of keeping such logbooks and synthesising the notes into easily accessible power point presentations as a deliverable.

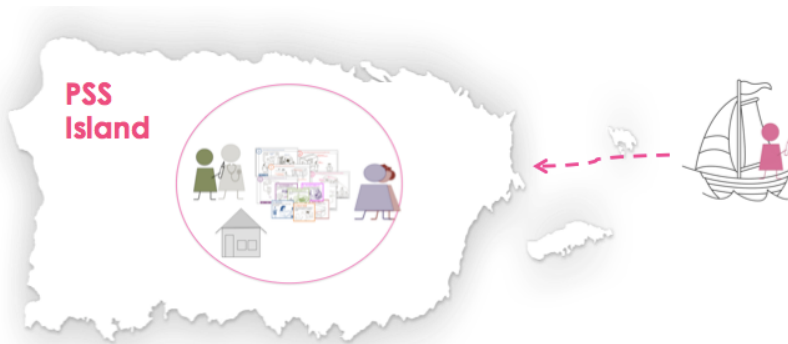


Figure 21: The PSS Island

LOG BOOK

The PSS Island tells the story of the navigational efforts of two external designers hired by a large pharmaceutical company to conduct user research in India. The company wanted to set up a couple of small pilot projects in India and Africa, targeting the Base Of the Pyramid (BoP) segment of the world's population living for less than one USD per day. The pharmaceutical company have a lot of sales personnel in both Africa and India; however, none of these are trained to engage in user-research and design activities. And even though the company has in-house anthropologists and designers, due to the scale of the company, the organisation has been forced to introduce streamlined procedures linking the tasks of the in-house anthropologists and designers to specific elements of the company's product portfolio. Furthermore they are to follow particular procedures and models such as the stage-gate-model as part of a larger setup, resulting in limited flexibility to explore new opportunities.

Hence, focusing on developing smaller pilot projects this design project was very different from typical design projects conducted by the company. Therefore a new division was set up, consisting of only 1,5 fulltime employees to explore possibilities of entering the markets of Africa and India. As the employees in the new division did not have any user research or design experience, a colleague of mine and myself were hired for the job to explore the potentials of providing insulin to the poor diabetes patients in rural India focusing on a service-perspective. By setting up a new division and hiring external designers to explore how insulin could be provided to the patients in India, the leader of this division was a central actor in the project. She was the one who could convince the company leaders to try something new, she was the contact-person and project owner in relation to the two designers, and she was the person who herself had a say in whether and how insulin was provided to the poor people in India. She had defined roles to the (to her) three main actors: the designers who was going to provide user insights from India, the patients who would want insulin to their doorstep, and the company management who wanted to expand their products to new customer segments and eventually should approve of the pilot-setup.

PREPARING THE RESEARCH TRIP

The designers decided to allow negotiations of the OPP by planning and preparing a research trip that would involve navigating a vast number of Prototyping Spaces. Normally, the representatives from the company would only engage with the doctors, as they are the ones writing prescriptions and thereby recommending a specific medicine, making them the main customer of the pharmaceutical company. Up until now, the doctors had also represented the patients in the interactions with the pharmaceutical company speaking on their behalf explaining what would be best for them in relation to the treatment of their disease. But with support from the leader of the BoP division, the designers promoted the mentality that the patients and other actors should be allowed to represent themselves. Thus they increased the diversity of actors to also involve direct engagements with for instance NGO representatives and vulnerable actors such as diabetes patients.

Before leaving for India, they arranged meetings with a variety of actors such as doctors, NGO-workers and entrepreneurial companies to get inspiration and knowledge from many sides and perspectives. Their schedule had many holes to be filled out during the trip, as the designers knew they could not set up specific meetings with patients before leaving for India. Instead they planned to use roll-the-snowball techniques to get in contact with a local NGO, who could set up meetings with diabetes patients the following day.

Preparing the interactions and developing prototypes

They designed 6 scenario cards and 6 value cards representing diverse aspects of the OPP, and were intended to serve as boundary objects for coordinating and negotiating matters of concern (see Figure 22). The scenario cards were developed for interaction with doctors, patients and NGO-workers, illustrating potential scenarios of how insulin could come closer to the patient (e.g. a woman delivering the insulin to the doorstep using a bike, a mobile pharmacy, a special clinic at the hospital etc.). To initiate a conversation about the roles of the people who was to be part of the final system, each scenario contained a number of different actors and objects aiming to evoke negotiations and mobilise the actors to become part of the final solution. The 6 value cards were developed specifically for exploring the motivations, thoughts and lives of the patients, and illustrated 6 aspects which the company imagined would be important and a matter of concern

(MoC), to the patients for instance availability of medicine, price, and the possibility of being injected with insulin as a service. The objective or purpose of the staging of the Prototyping Spaces with these cards was not for the actors to choose a certain favourite scenario, instead they were meant to start a conversation and open up for discussion, negotiation and mutual learning. In total the designers engaged with 20 patients and a number of doctors and NGO-workers, and furthermore, they sought inspiration from an entrepreneurial company selling glasses to the poor, rural Indian population.



Figure 22: Illustration of the scenario-cards (left) and value-cards (right)

NAVIGATING PROTOTYPING SPACES IN INDIA

The 6 scenario cards was used in every Prototyping Space, while the 6 value-cards was only used in the spaces involving diabetes patients. Using the 6 scenario-cards in every interaction meant, that there was a similar structure to the various interactions, and as the designers engaged in more and more spaces, they would draw from the insights learned in the previous spaces to add to these inputs in the discussion and negotiation taking place in the following space. Especially in this case, it was important that the designers were able to represent the knowledge and the negotiations taking place in the previous spaces, as it was not possible to gather many actors in e.g. a workshop. There were several reasons to this, one being that diabetes is quite stigmatised in India causing the patients keep a low profile about their disease, and the other that the Indian culture and society is highly hierarchical potentially causing the patients not to feel comfortable expressing conflicting viewpoints to those of a doctor present.

To give a concrete example of how the designers represented the knowledge of the patients in the next spaces the following vignette illus-

trates how the materiality (in this case the value cards) were adapted based on translation and synthesis of the inputs from one of the diabetes patients.

Looking at the 6 value cards the diabetes patient suddenly exclaimed: 'What about the quality of the medicine?'. The researchers looked a bit baffled at him and at each other, and asked him to elaborate what he meant. He told the designers, that they had huge problems in India with counterfeit medicine, and that even though a medicine package looked original, you never knew for sure whether the medicine was genuine or not. The designers quickly reacted to this input by preparing a new game piece with the word 'Quality' on it, which could be ranked alongside the other values to test if other patients felt the same. The patient ranked Quality of the medicine to be the most important aspect of being a diabetes patient in India, and in the following spaces the majority of the patients ranked the Quality-card the most important value.

The patient brought a new important value to the table, Quality, which turned out to be a matter of great concern to diabetes patients in India.

Controversies arose

Due to the large number of actors involved in the design process, the designers expected a lot of contradicting inputs and controversies. Many of the contradicting inputs had to do with different cultural aspects. For instance one doctor said: *'Women don't bike! That is just the way it is'*, while an NGO worker exclaimed: *'Women do bike! It seems progressive'*. As the designers received conflicting statements from the experts (doctor and NGO-worker) they also asked the patients about this issue to see if they could clarify. However, also the patients had different opinions as some of them would bike and others not. Instead of being confused in terms of which statement was correct, the designers instead noted, that the final system would need flexibility in terms of the means of transportation depending on the specific local area.

Negotiating actor-roles

As mentioned, the scenarios were designed to initiate mutual learning and insights about the local culture, but also to have the different actors discuss and negotiate actor-roles in the final system. An expert noted: *'In urban and suburban areas an entrepreneur would not have full credibility because the population only trust doctors. However, it might work if the entrepreneur is*

a nurse.’ But even though the NGOs wanted to promote their work, they were also aware that their employed health workers (Ashas) should continue their current work rather than getting more work by being the ones distributing the insulin and giving injections: *‘She should not be an Asha though, because these already have a lot of work under the government programs – but they can still support each other in the local community as health workers’*. Still another actor directed attention towards potential conflicts of interest: *‘It is important to link up with the doctor instead of the pharmacies as the pharmacies will otherwise see the entrepreneur as competition.’*

Engaging with representatives from pharmaceutical company

Once the designers returned to Denmark, they began synthesising their empirical material into insights to be presented to the leader of the BoP division. Based on an affinity diagram, the designers had identified overall themes in the material, which they used to structure the presentation around. Personas was included in the presentation representing archetypes of the engaged diabetes patients along with quotes and pictures to create empathy for the patients and provide insights into their lives and values. Based on all this material the designers eventually developed a flexible product service system (PSS) consisting of diabetes patients, doctors, NGO-workers, entrepreneurs, insulin, needles, bikes, kiosks, company representatives, refrigerators etc.

They represented the PSS with a drawing of the system and designed storyboards illustrating how the personas would use the system. For handing over the empirical material and share knowledge with the BoP leader, the designers staged a Prototyping Space configured with the background report, the illustration of the PSS, and the storyboard and pictures and quotes which all became part of the temporary décor of the living room where the meeting was to take place. This space was staged to work as an interessement device for interesting the leader of the BoP department of the company to become enrolled and mobilised to set up a pilot project testing the PSS. Having engaging a whole range of diverse actors in the design process with conflicting viewpoints, the final solution represented the negotiations and insights generated as an outcome of these negotiations. Hence a lot of detailed and nuanced knowledge about the motivations and desires of various actor-groups was inscribed in the materiality presented in the space. The materiality and the stories told by the designers worked well as interessement devices as they represented the voices of

nearly all the human actors in the proposed network. The designers' efforts and navigation of the space, worked according to the plan, as the BoP leader was easily convinced and eager to set up the pilot project right away. Once the company manager was mobilised the next task was to interest the decision makers of the company who would allocate funding to the project. In order for them to make a decision to allocate funding for the pilot, the knowledge presented in the project report and the illustration of the solution, was to be transformed and adapted to a special company Power Point template used for decision-making purposes. This template was a particularly important element in the Prototyping Space, and the designers struggled to translate their qualitative knowledge and findings into quantitative parameters set up by the decision makers to support the decision making process. In this situation, the success of the designers to comply with the power point template was the single most important element, which would determine whether the decisions makers became interested in the project. Luckily the managers were satisfied with the potentials of the solution, and a pilot project was set up in India. This is where my involvement in the project came to an end, but I learned later on, that the pilot project won the Pharmaceutical Market Excellence Award (PMEA) in 2013 given to innovative BoP-projects. Please refer to article 3 for more information (Pedersen & Brodersen, 2016).

DISCUSSION

ITERATIVE STAGING, FACILITATION, AND SYNTHESIS

While the other cases have illustrated how navigation is an iterative process repeated a number of times during the design process, this case further highlights this aspect by illustrating agile behaviour in terms of re-configuring the space during facilitation. In the interaction with one of the diabetes patients, the patient suggests Quality as a new value, and instantly the designers reconfigure the space by synthesising the user-insights into a Quality-card on the fly. Hence it seems as if navigation entails the ability to instantly switch between facilitation, synthesis and reconfiguration or staging. The instant development of a new value-card was made possible because the designers in preparing for the trip and the interactions had brought with them blank cards which could be filled in based on the interactions. Hence planning for flexibility seems to be a key aspect of navigation.

THE OBLIGATORY PASSAGE POINT IS UP FOR NEGOTIATION

The fact that so many diabetes patients ranked the new Quality card very important came to affect the OPP of 'bringing insulin closer to the patient'. Quality of the medicine was indeed a matter of concern (MoC) to the diabetes patients, and hence it was immediately turned into a representation of a MoC, a value card. It turned out that the greatest MoCs for many patients was to get high quality insulin delivered at their doorstep and injected from a health worker. Hence, the OPP was modified to involve 'bringing safe and high quality insulin to the patient's doorstep'. Similarly to the other cases, the OPP is explored and negotiated in the initial Prototyping Spaces, and this time around 20 people are involved in these negotiations! Now, in order for the company to be able to set up an entire system providing safe, high quality insulin to the patients in the rural areas, they need to build a network of objects and actors to support this system.

BUILDING NETWORKS – NEGOTIATING ROLES

In their planning, the designers discussed whom they wanted to play an active part in the network of the final solution, and whom they only had to interest in the initial Prototyping Spaces. They strategically staged Prototyping Spaces with diverse and important actors such as NGO-workers, doctors and patients to not only share knowledge, but also to allow them to negotiate the OPP and potentially their own role in the future network. Other actors were invited to participate in the spaces due to their experience with similar projects. For instance, the glasses-entrepreneur was never intended translated to support the network; instead he was to share his experience with how to deliver a product and a service to the doorsteps of the rural, Indian population.

While the patients had the power to adapt the OPP, the actors who would potentially play a role in the final network had the power to negotiate their role in this future network. Having designed the scenarios to portray many different actors involved in various ways sparked a negotiation of the roles of the actors in the final solution as part of the mobilization of actors. And involving many actors to negotiate this naturally means a lot of negotiations and potentially a lot of controversies in terms of conflicting motivations from the different actors. To give some examples of such controversies: it is important for the NGOs to fulfil their mission in terms of helping a large number of diabetes patients (but also to make sure, that their health workers should not be given a bigger workload than they already have), the

doctor wants his patients to be treated in order to have a minimum of symptoms (and to promote his own clinic to get more clients), the patients want pure medicine which is not counterfeit so they can feel better, and the pharmaceutical company wants to help more patients by selling more insulin (and to make a profit). This way, the designers had an idea of who wanted to be part of the network and who did not, and at what price. Also new actors and objects were introduced during the negotiations. For instance pharmacists and quacks was also to be a part of the system, as they would otherwise work against it (as indicated by the quote on page 57). Hence the negotiations with the initially identified actors kept leading to more, and more actors to be involved in the system spanning the final PSS.

This indicates a coordinating role assigned to the designer which is in line with the ideas of Star and Griesemer (1989) about Boundary Objects that coordinates design efforts rather than a single actor assigning roles and trying to manipulate the other actors to participate, which is how Callon's version of translation (Callon, 1986) might be interpreted. This case (as well as the others) indicates a more democratic process, where not only the OPP but also the roles of the allies in the final network is negotiated and taken into account in the final design.

But not only the roles of the human actors are to be negotiated. The scenario-cards are designed to also encourage negotiations about the materiality, which is to be part of the network. E.g. the woman riding a bike became a central point of the negotiations, as the actors had different views on this prospect. Also discussion and negotiations highlighted the need for a generator to power refrigerators that where to keep the insulin chilled in an otherwise hot environment without constant electricity. This case clearly illustrates how a single product is not always the sole object of design. Instead an entire network of doctors, NGOs, health workers, high quality insulin, bikes, generators, refrigerators etc. are to be designed and their roles negotiated during the design process.

Figure 23 illustrates how the outcome of the negotiations (changes in OPP, knowledge about the non-designers role and motivations and other insights) are synthesised and flows from one space to the next, and eventually ends up constituting a solution consisting of a network of actors and objects.

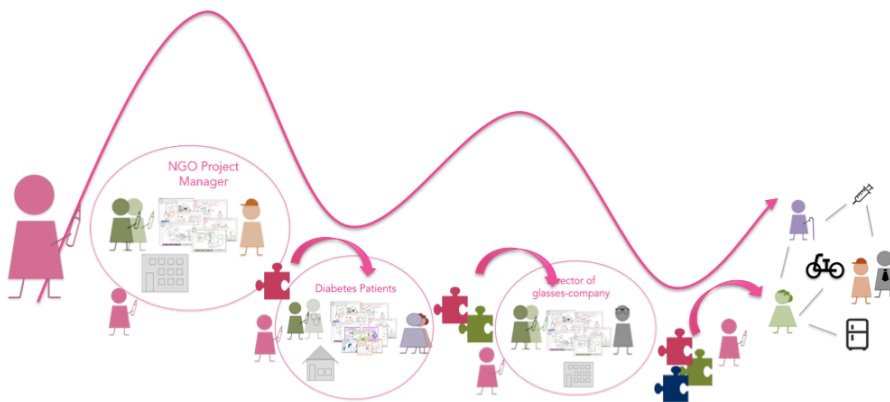


Figure 23: Illustration of the design process

Designing flexible solutions consisting of networks

Besides from coordinating actor-roles, the democratic negotiations also make the designers aware of potential pitfalls pointing towards areas where the solution needs to be flexible. When I use the word flexible, I mean a solution that can be adapted to local circumstances and challenges. In one area a health worker bikes from a central storage unit with a refrigerator to the patients' home, while in another, a male and a female go together on a scooter. The high quality insulin is not only to be delivered to the patients' doorstep, there is also a need for high quality insulin available at the local hospitals so patients who do not wish to get injections, and pay for the service, still have access to the medicine etc. Designing flexible solutions means that many different scenarios need to be thought through rather than only having *one* solution or network to be readily implemented everywhere. This however, stands in rather sharp contrast to the idea, promoted by many companies, that once they have done a pilot project, they can effortlessly scale up and apply this to any other settings. This is quite similar to what happened at the PPI Island, where new adventures in China did not entail selling the Danish version of the sensory delivery room, but instead new local negotiations and design. It seems that companies need to design flexible solutions, and be willing to go through new negotiations to modify the solution to fit the exact needs of the specific customers and users. Even though it undoubtedly takes more time and effort than selling a standard-product. Seeing complex solutions as networks provides sensitivity towards the negotiations of roles while at the same time creating ownership that

challenges the ‘not invented here’ syndrome, which flourishes in the PPI community in particular.

CONTRIBUTIONS

While the previous cases have illustrated how navigation in terms of staging, facilitation and synthesis is a way to translate knowledge and actors, this case adds to the picture by illustrating how navigating Prototyping Spaces as well as the entire design process might entail reconfiguration of the space on the fly during the facilitation phase showing agile behaviour. This further stresses the iterative nature of navigation and what it actually entails. By immediately synthesising the new matter of concern identified into a value card, the designers utilise their ability to shift between facilitation, synthesis and re-configuration (staging), which eventually leads to a modification of the OPP.

Again we see how navigating the Prototyping Spaces leads to a modification of the OPP, but this case also highlights the importance of negotiating actor-roles. This case illustrates how the object of design in complex settings is in fact a network consisting of objects and actors. And the roles of actors and objects to be played in the network is an outcome of the negotiations taking part in the Prototyping Spaces along with the translation of knowledge and actors. Rather than being a result of the manipulation of a designer, the roles of the network are instead democratically negotiated by the actors invited to participate in the spaces. And the invited actors also raise issues that brings more actors such as pharmacists and quacks to the network. Interestingly not only the roles of the human actors are negotiated, but also the roles of different objects such as bikes, generators, refrigerators, needles etc., which points to aspects of the network that needs to be adaptable to local customs, culture and circumstances. Thus, rather than designing standardised solutions to be readily sold everywhere in complex settings there is a need for designing flexible networks, which eventually promotes ownership and project success.

Filled up with experiences, impressions and reflections about all the things I had seen on my journey, it was time for me to return back to the safe haven of Aalborg University and my supervisors! Once I returned home, I was eager to tell about my experiences, but it would take many days to describe

all my insights. In order not to tire my supervisors too much with stories of my adventures, I knew that I had to sum up my findings. It has been a difficult task, but luckily I had my mission of the beginning of the journey, and I will aim to answer the questions, which I set out to explore.

CHAPTER 7. DISCUSSION AND CONTRIBUTIONS

In this final chapter I will sum up my findings and contributions and suggest further research. My compass (research question) has guided me on my journey towards the three islands and allowed me to focus my research. And my strives to answer this question during my journey has allowed me to fulfil my mission:

How to use theoretical elements from ANT and practical approaches from Participatory Design to inform design practitioners of how to navigate design processes with objects and a multiplicity of actors in order to enable knowledge sharing and development of products, services and systems in global healthcare sectors?

Mission: 1) Explore how knowledge is translated in participatory design practices in a business context, 2) to develop an operationalized approach for design practitioners, 3) to inform the scholarly discussions on ANT and Participatory Design based on insights from case studies, and 4) to inform the healthcare setting.

TRANSLATION OF KNOWLEDGE

I started this journey looking into how knowledge is translated in a business-context within healthcare. Designing products, services and systems for the healthcare context is an interesting but also challenging task for the designer and project manager as knowledge from numerous diverse actors is to be coordinated and navigated along with timeframes, project management tools and procedures to drive the design process forward. Visiting the three islands, and drawing from Boundary Object and prototype-literature, I became aware how prototyping, focusing on various forms and fidelity of prototypes, is a key element in translation of knowledge as it influences the interactions and engagement between actors across organisational as well as professional and cultural boundaries (see e.g. Beaudouin-Lafon & Mackay, 2003; Blomkvist & Holmlid, 2011; Carlile, 2002; Star & Griesemer, 1989). However, prototyping and boundary object literature

often focus on roles and properties related to the object in question, and on the bigger picture in terms of how the interactions are staged and facilitated, and how the knowledge is translated to be used later on in the design process. Through my cases I have illustrated that prototyping and navigation are closely related, as navigation help explain how interactions between actors is to be staged, facilitated and synthesised in iterative loops.

Developing and introducing Navigating Prototyping Spaces as a sensitising device has allowed me to analyse the three cases with the aim of understanding navigational aspects, and has led me to suggest the role of the designer as a navigator rather than a mere map circulator (Storni, 2015). I have drawn upon ANT to bring forward some of the central aspects of navigation, as the designer navigates Prototyping Spaces using materiality and agility to translate knowledge as well as actors at various moments during the design process where matters of concern are negotiated, interpreted and reframed. My cases illustrate how patients, doctors, loved ones, occupational therapists, midwives, light bulbs, luminous textile, apps, insulin, bikes etc. all are to be engaged in a process of translation using storyboards, pictures, quotes, apps, reports, illustrations etc. as boundary objects as a starting point for negotiating motivations, experiences, values etc. as well as potential roles in the network of the final solutions (see Figure 24).

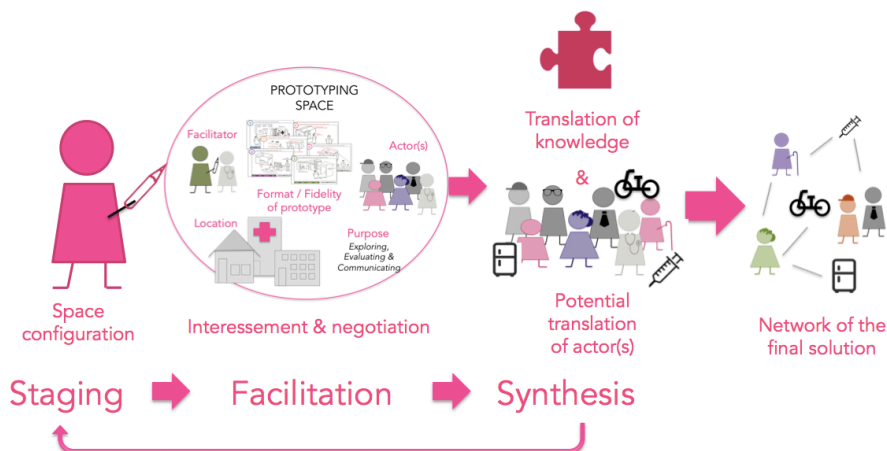


Figure 24: Through interessement and negotiation both knowledge and actors are translated to play a role in the final solution

'NAVIGATING PROTOTYPING SPACES'

I have developed and introduced the concept and operationalized approach of Navigating Prototyping Spaces to draw attention towards navigational aspects in Participatory Design and propose operationalized strategies and concepts related to navigation.

Prototyping Spaces

While the prototype literature is centred around how to engage with prototypes, Prototyping Spaces directs attention towards a number of configuring elements which designers need to take into account when staging and facilitating design interactions with non-designers as well as with colleagues with the aim of translating knowledge and foster mutual learning. These design interactions can be seen as temporary spaces for design and innovation (Clausen & Gunn, 2015) which I term Prototyping Spaces to direct attention towards the role of materiality (prototypes) as boundary objects for translation of knowledge and towards the process aspect and iterative nature of navigating spaces and their outcome.

Furthermore the concept can handle temporality, an important aspect related to the step-wise and iterative process of design, that the concept of networks finds it difficult to grasp, as these are seen to be fluid and always in the making. The notion of spaces capture the temporality of the diverse engagements during a design process and provide sensitivity towards design as a process where the solution is not introduced until the end of the process. Prototyping Spaces represent certain moments in the design process where knowledge is negotiated with diverse actors, and afterwards translated and synthesised by a design so it can be used in future spaces – making navigation a continuous and iterative process.

Navigation

In my suggestion of navigation, I am inspired by skills mastered by explorers at sea and build on the four elements of prototyping processes suggested by Floyd (Floyd, 1984). Drawing on this inspiration I have proposed three stages of navigation in design; staging, facilitation and synthesis. The advantage of introducing my interpretation of navigation is that it allows us to direct attention towards a number of configuring elements of the space, rather than only focusing on the prototype itself. Furthermore, navigation is sensitive towards the political nature of the design process, as navigation also should draw our attention towards strategic issues in terms of ensuring

that the most relevant actors are involved at an early stage or moment in the process. Some actors are invited to participate as partners in the design process, while others are either brought into the process by other actors, or are imposing their opinions by having a position where they play an important part in the design process. For instance the BU-manager at the OI Island was not directly involved in the process until he put an end to it by refusing to sell the new solution as part of his current portfolio.

By introducing Prototyping Spaces as a frame for understanding strategies for navigation I have taken the first steps to contributing with operationalized strategies and methods for navigation in Participatory Design. As with the early explorers sailing the seas of the world navigation is not easily taught as it is mainly learned based on experience and reflection, which is also advocated by Schön (1984). However, I have suggested some concepts to support this reflection and learning (see Figure 25):

First of all, who should be in charge of staging the interaction? If the person staging and facilitating the space is one and the same, it is more likely, that the configuring elements work to the advantage of the facilitator in terms of fostering negotiations and translation of knowledge and of the actor(s) involved. However, if the person facilitating is not the same as the one staging the space, more coordination and perhaps an interview guide might be necessary - as was the case at the OI Island. Staging the prototyping space entail designing and coordinating the five configuring elements of the prototyping spaces: a facilitator, a non-designer, a prototype, the material arrangement of the setting, and a situated purpose that are all related to and dependent on the moment in the design process. Eventually the knowledge generated in the space is to be synthesised so it can be shared with actors in the next prototyping space who may have certain expectations as to which type of insights and knowledge is important. For instance the decision-makers from the pharmaceutical company needed the insights presented in a certain qualitatively informed power point template in order to make a decision of whether to set up a pilot project. The synthesised knowledge might also serve as documentation of the decisions made and the progress of the design process. Each 'prototype' is a constituent of the object of design and hence a primary source of knowledge about the progress and the way the final solution came to be.

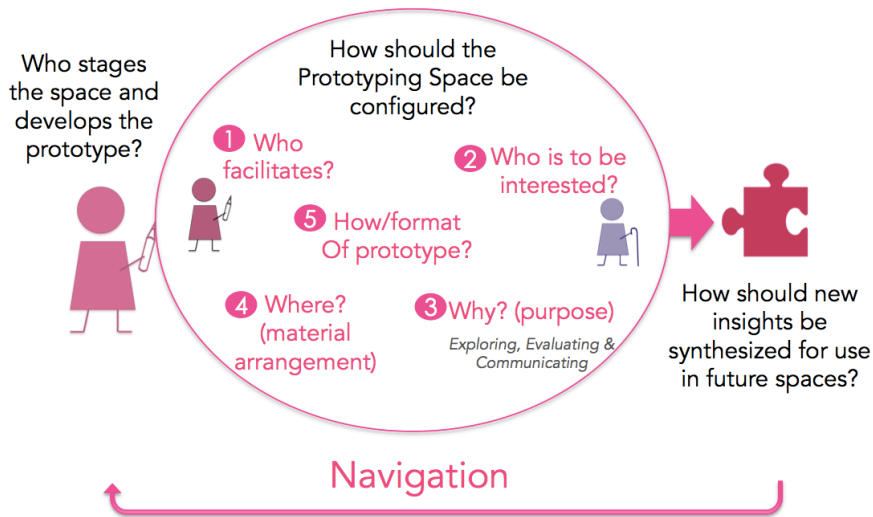


Figure 25: The concept and approach of Navigating Prototyping Spaces

ADDING TO DISCUSSIONS ON ANT AND DESIGN

BUILDING NETWORKS

Designing for the healthcare context involves navigating a number of Prototyping Spaces with diverse actors who advocate conflicting interests and desires. However, instead of seeing this as a limitation they might instead be used to promote and facilitate negotiation to make sure that the solutions address matters of concern, and push us to develop flexible solutions. Another result of these negotiations is the formation of allies who support and wants to play a role in the network of the final solution. ANT highlights the process of network-building, but is traditionally used in a highly descriptive manner to explain how something came to happen. Drawing inspiration from ANT, I suggest, that instead of designing objects, participatory designers need to shift their attention from a focus on the object to an increased sensitivity towards designing networks of objects and actors (see Figure 26).

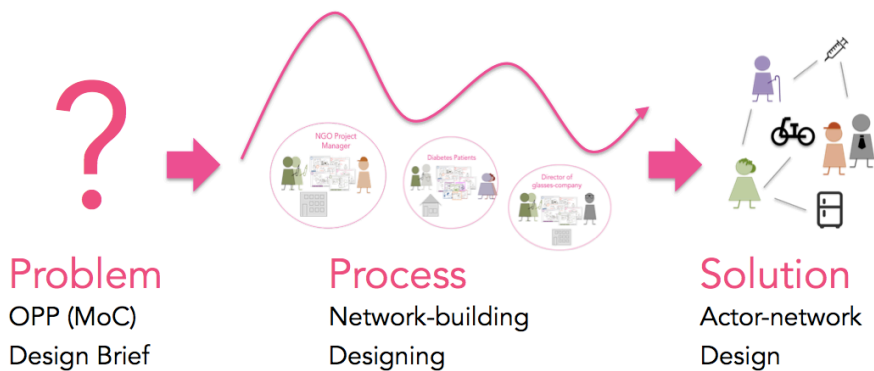


Figure 26: The OPP is negotiated in Prototyping Spaces during the design process, while also the roles in the network constituting the final solution is negotiated

TRADITIONAL ANT VS. PARTICIPATORY NETWORK BUILDING

Borrowing elements from ANT and Participatory Design might inspire to a more prescriptive way of understanding network-building that I here term Participatory Network Building. In Table 2 I have summarised the difference between what I term traditional network-building and participatory network-building.

Table 2: Classical ANT network-building versus participatory network building

Classical ANT network building	Vs.	Participatory network building
Descriptive	vs.	Prescriptive
Manipulation (one actor)	vs.	Collective Staging (more actors)
Persuasion	vs.	Negotiation
A single OPP which contribute to align actors in network-building	vs.	A collective OPP negotiated and adapted by multiple actors

In line with Traditional ANT, the three cases points towards translation being an important aspect of network building. However, instead of having one entrepreneur or designer being the manipulator trying to translate the actors to play certain roles in an already defined network, Participatory Design contributes by focusing on negotiation. Hence, what characterises Participatory Network Building is the focus on how properly staged and facilitated prototyping spaces might service as an intersement device while encouraging negotiations of matters of concern and of their potential role in the network. This is somewhat in line with Latour's more recent work where he draws attention towards negotiations in Parliaments of Things (Latour, 2005). However, Latour does not explain how these parliaments are staged and configured let alone facilitated or what comes out of these negotiations and how it is taken forward and used.

I draw on ANT to suggest that the concepts of navigation and Prototyping Spaces might assist in staging and facilitating negotiations and make sure that the outcome is translated and transformed into knowledge and insights to build on in the design process. My cases suggest, that prototypes may be useful representations of obligatory passage points and of insights, which are central to these negotiations. These negotiations might foster a modification in the OPP to make sure that it is a matter of concern to the involved actors. The development of the OPP becomes a collaborative endeavour rather than the promotion of an already identified solution (Callon, 1986).

And as mentioned they also foster negotiations about actor-roles in the future network. This is often a distributed process, where the designer needs to synthesise and represent the knowledge and insights from the previous spaces and take these into the next. This is for instance the case in the PSS-case where strong hierarchy forces doctors and patients to be engaged in separate Prototyping Spaces to allow for the patients to speak freely.

CONTRIBUTIONS TO HEALTHCARE

The sensitising devices of navigation and Prototyping Spaces have contributed to point to challenges in the healthcare sector such as the importance of involving and engaging a number of actors in the design process and

designing flexible solutions to enhance the sense of ownership, and illustrated how these sensitising devices and strategies might prove useful.

As mentioned, healthcare is populated with extremely diverse actors each having their own perspectives, aspirations and motivations. Healthcare is also characterised by involving vulnerable actors such as patients recovering from a severe stroke and poor Indian diabetes patients. It is important to note, that the motivations and knowledge of the patients is equally important to those of actors with a higher status such as doctors. The concept of Navigating Prototyping Spaces helps in directing attention to how these diverse actors might need to be involved and addressed in different ways to support their involvement. And the cases illustrate how the space is to be configured dependent on the actor to be involved in order to work as inter-essement device. For instance the storyboards were too long and difficult for some of the stroke-patients to understand, while the specific power point template format was needed to convince the decision makers from the pharmaceutical company to approve the pilot project in India. But even though the actors should be involved in different spaces it is important that they are all involved. Seeing the object of design as a network rather than an object might direct attention towards the idea that involvement of many actors allow for negotiations of their potential role in the final network and promotes the feeling of ownership of the final solution. And especially the PPI Island illustrates the importance of ownership in a healthcare setting where practitioners who are to use and maintain the solution play a central role in the design process.

Due to the many PPI projects in Denmark, there have been a large number of pilot projects that has experienced difficulties when attempting scaling up their activities. One of the reasons given is the lack of ownership in terms of the 'not invented here' syndrome. Based on my experiences at the three islands, I suggest that designing flexible networks is a key aspect to overcome this gap between pilot and scale up of complex projects. The experiences from the PPI Island at the PSS Islands suggests, that each new 'sale' of the solution entail participatory network-building in terms of new negotiations and potential adaptations to translate actors to become allies and support the final, local solution. However, as advocated by Schön (1984), the design practitioner should treat each situation as unique, but they do not start from scratch.

FURTHER ADVENTURES

As the concept and approach of Navigating Prototyping Spaces is still in the making, in the future I wish to further qualify the approach and test it's usefulness in analysing translation of knowledge and in navigating design processes. Doing so, it might be interesting to explore new countries and parts of the world. The land of Healthcare is complex, but so are many other areas dealing with objects of design that needs to fit into larger systems such as sustainable cities, transportation systems and product-service systems in general. Hence I imagine that the lessons learned from engaging with Healthcare can also be used as a source of inspiration when travelling and engaging in participatory design activities elsewhere. Thus, I am more than motivated to set out on more exploratory journeys in the future to learn even more about translation of knowledge and actors in design.

For those journeys it might be interesting to stock my library with another section of literature. As companies are important drivers for design and innovation activities, but find it hard to make use of the Participatory Design practice and methods (Buur & Matthews, 2008), it would perhaps be beneficial to look more into the design & innovation management tradition to further understand their current view on how knowledge and design is translated and practiced in companies. Open Innovation has sensitivity towards involving users in design, but my research points to the value of navigating involvement of a number of actors in designing networks. Having a better understanding of prevalent ideas within this tradition will enable me to focus the presentation of my concepts and ideas in a language and by material representations that they understand and accept. Thus the mission for my next journey might be to stage a prototyping space with concepts represented by boundary objects, with the aim of negotiating these concepts together with scholars and practitioners within this field, as part of a process of developing a framework that might inform these actors.

BIBLIOGRAPHY

- Akrich, M., Callon, M., Latour, B., & Monaghan, A. (2002). the Key To Success in Innovation Part i: the Art of Interessement. *International Journal of Innovation Management*, 6(2), 207–225.
- Andersen, L. B., Danholt, P., Halskov, K., Hansen, N. B., & Lauritsen, P. (2015). Participation as a matter of concern in participatory design. *CoDesign*, (October), 1–12.
- Andreasen, M. M., Hansen, C. T., & Cash, P. (2015). Conceptual design: Interpretations, mindset and models. *Conceptual Design: Interpretations, Mindset and Models*, (May), 1–394.
- Beaudouin-Lafon, M., & Mackay, W. E. (2003). Prototyping Tools and Techniques. In J. A. Jacko & A. Sears (Eds.), *Human-Cumputer Interaction Handbook* (pp. 1006–1031). Hillsdale, NJ, USA: L. Erlbaum Associates Inc.
- Berreman, G. D. (1966). Anemic and Emetic Analyses in Social Anthropology. *American Anthropologist*, 68(2), 346–354.
- Binder, T., & Brandt, E. (2008). The Design:Lab as platform in participatory design research. *CoDesign*, 4(2), 115–129.
- Binder, T., Brandt, E., Ehn, P., & Halse, J. (2015). Democratic design experiments: between parliament and laboratory. *CoDesign*, (October), 1–14.
- Binder, T., Ehn, P., Jacucci, G., Linde, P., & Wagner, I. (2011). *Design Things*. Cambridge: MIT Press.
- Björgvinsson, E. B., Ehn, P., & Hillgren, P. (2010). Participatory design and “democratizing innovation,” (Ehn 1988).
- Björgvinsson, E. B., Ehn, P., & Hillgren, P.-A. (2012). Design Things and Design Thinking: Contemporary Participatory Design Challenges. *Design Issues*, 28(3), 101–116.

- Blanco, E., & Boujut, J.-F. (2003). Intermediary Objects as a mean to foster Co-operation. *Engineering Design Computer Supported Cooperative Work*, vol 12(n° 2), p 205 – 219.
- Blok, A., & Jensen, T. E. (2009). *Bruno Latour Hybride tanker i en hybrid verden* (1st ed.). Copenhagen: Hans Reitzels.
- Blomkvist, J., & Holmlid, S. (2011). Existing Prototyping Perspectives: Considerations for Service Design. In *Nordic Design Research Conference* (pp. 1–10). Helsinki.
- Boer, L., & Donovan, J. (2012). Provotypes for participatory innovation. *Proceedings of the Designing Interactive Systems Conference on - DIS '12*, 388.
- Bogers, M., & Horst, W. (2014). Collaborative prototyping: Cross-fertilization of knowledge in prototype-driven problem solving. *Journal of Product Innovation Management*, 31(4), 744–764.
- Brandt, E. (2006). Designing Exploratory Design Games: A Framework for Participation in Participatory Design? *Proceedings of the Ninth Participatory Design Conference*, 57–66.
- Brandt, E. (2007). How Tangible Mock-Ups Support Design Collaboration. *Knowledge, Technology & Policy*, 20(3), 179–192.
- Brandt, E., Binder, T., & Sanders, E. B.-N. (2012). Tools and Techniques: Ways to Engage Telling, Making and Enacting. In J. Simonsen & T. Robertson (Eds.), *Routledge International Handbook of Participatory Design* (pp. 145–181). New York: Routledge.
- Brandt, E., Johansson, M., & Messeter, J. (2005). The design lab: re-thinking what to design and how to design. In T. Binder & M. Hellström (Eds.), *Design Spaces* (pp. 34–43). Finland: Edita Publishing Ltd IT Press.
- Brandt, E., Messeter, J., & Binder, T. (2008). Formatting design dialogues – games and participation. *CoDesign*, 4(1), 51–64.

- Bratteteig, T., & Gregory, J. (2001). Understanding Design. *Proceedings of the 24th Information Systems Research Seminar in Scandinavia (IRIS 24)*, 3.
- Brodersen, C., Dindler, C., & Iversen, O. S. (2008). Staging imaginative places for participatory prototyping. *CoDesign*, 4(1), 19–30.
- Brogaard, L., & Petersen, O. H. (2014). *Offentlige-private innovationspartnerskaber (OPI)*.
- Bucciarelli, L. L. (1994). *Designing Engineers*. MIT Press.
- Buskermolen, D. O., Terken, J., Eggen, B., & Loenen, E. Van. (2015). Effect of Visual Quality and Animation of Concept Representations on Users' Responses to Early Design Concepts: A Study on the Adaptive Patient Room Concept. *International Journal of Design*, 9(1), 91–106.
- Buur, J., & Larsen, H. (2010). The quality of conversations in participatory innovation. *CoDesign*, 6(3), 121–138.
- Buur, J., & Matthews, B. (2008). Participatory Innovation. *International Journal of Innovation Management*, 12(3), 255–273.
- Bødker, S. (1987). Through the Interface - A Human Activity Approach to User Interface Design. *DAIMI Report Series*, 16(224).
- Callon, M. (1986). Some Elements Of A Sociology Of Translation: Domestication Of The Scallops And The Fishermen Of St Brieuc Bay. In J. Law (Ed.), *Power, action and belief: a new sociology of knowledge?* (pp. 196–223). London: Routledge.
- Callon, M., & Latour, B. (1981). *Unscrewing the big Leviathan: How actors macro-structure reality and how sociologists help them to do so. Advances in Social Theory and Methodology: Toward an integration of micro and macro-sociologies*.
- Carlile, P. R. (2002). A Pragmatic View of Knowledge and Boundaries: Boundary Objects in New Product Development. *Organization Science*, 13(July 2014), 442–455.

- Carlile, P. R. (2004). Transferring, Translating, and Transforming: An Integrative Framework for Managing Knowledge Across Boundaries. *Organization Science*, 15(5), 555–568.
- Cherkasky, T. (2003). Designing Experience. *International Journal of Engineering Education*, 19(1), 9–15.
- Chesbrough, H. W. (2006). *Open Innovation: The New Imperative for Creating And Profiting from Technology* (1st ed.). Boston, Massachusetts: Harvard Business School Press.
- Clarke, A. (2005). *Situational Analysis - Grounded theory after the postmodern turn*. Sage Publications Inc.
- Clausen, C., & Gunn, W. (2015). From the Social Shaping of Technology to the Staging of Temporary Spaces of Innovation – A Case of Participatory Innovation. *Science & Technology Studies*, 28(1), 73–94.
- Clausen, C., & Yoshinaka, Y. (2007). Staging socio-technical spaces: translating across boundaries in design. *Journal of Design Research*, 6(1), 61–78.
- Cooper, R. (1990). Stage-gate systems: A new tool for managing new products. *Business Horizons*, 3(33), 44–55.
- Dawson, P. (2000). Technology, Work Restructuring and the Orchestration of a Rational Narrative in the Pursuit of “Management Objectives”: The Political Process of Plant-level Change. *Technology Analysis & Strategic Management*, 12(1), 39–58.
- de Laet, M., & Mol, A. (2000). The Zimbabwe Bush Pump: Mechanics of a Fluid Technology. *Social Studies of Science*, 30(2), 225–263.
- DeWalt, K. M., DeWalt R., B., & Wayland, C. B. (1998). Participant Observation. *Handbook of Methods in Cultural Anthropology*.
- Emerson, M. R. (1995). Fieldnotes in Ethnographic Research. *University of Chicago Press*, 1–32.

- Floyd, C. (1984). A Systematic Look at Prototyping. In R. Budde, K. Kuhlenkamp, L. Mathiassen, & H. Züllighoven (Eds.), *Approaches To Prototyping* (pp. 1–18). Springer Berlin Heidelberg.
- Gardien, P., Djajadiningrat, T., Hummels, C., & Brombacher, A. (2014). Changing your Hammer: The Implications of Paradigmatic Innovation for Design Practice. *International Journal of Design*, 8(2), 119–139.
- Geertz, C. (1973). Thick description: Toward an interpretive theory of culture. *The Interpretation of Cultures*, (4), 310–323.
- Goffman, E., & Lofland, L. H. (1989). On Fieldwork. *Journal of Contemporary Ethnography*, 18(2), 123–132.
- Gregory, J. (2003). Scandinavian Approaches to Participatory Design. *International Journal of Engaging Education*, 19(1), 62–74.
- Halskov, K., & Hansen, N. B. (2014). The diversity of participatory design research practice at PDC 2002–2012. *International Journal of Human-Computer Studies*, 74, 81–92.
- Hampl, P. (1987). *Spillville*. Minneapolis: Milkweed Editions.
- Henderson, K. (1991). Flexible Sketches and Inflexible Data Bases: Visual Communication, Conscription Devices, and Boundary Objects in Design Engineering. *Science, Technology & Human Values*, 16(4), 448–473.
- Hitt, M. a., Keats, B. W., & DeMarie, S. M. (1998). Navigating in the new competitive landscape: Building strategic flexibility and competitive advantage in the 21st century. *Academy of Management Perspectives*, 12(4), 22–42.
- Houde, S., & Hill, C. (1997). What do Prototypes Prototype? *Handbook of Human Computer Interaction*, 1–16.
- Hussain, S., Sanders, E. B.-N., & Steinert, M. (2012). Participatory design with marginalized people in developing countries: Challenges and opportunities experienced in a field study in Cambodia. *International Journal of Design*, 6(2), 91–109.

- Iacucci, G., & Kuutti, K. (2002). Everyday life as a stage in creating and performing scenarios for wireless devices. *Personal and Ubiquitous Computing*, 6(4), 299–306.
- Ilstedt Hjelm, S. (2005). If everything is design, what then is a designer? In *In the making: Nordic Design Research Conference*. Copenhagen.
- Jensen, P. B., Steinicke, M., Nielsen, C., & Nielsen, M. S. (2013). *OPI Guide til virksomheder*.
- Kensing, F., & Blomberg, J. (1998). Participatory Design: Issues and Concerns. *Computer Supported Cooperative Work (CSCW)*, 7, 167–185.
- Kensing, F., Simonsen, J., & Bødker, K. (1998). Participatory Design at a Radio Station. *Computer Supported Cooperative Work*, 7, 243–271.
- Kimble, C., Grenier, C., & Goglio-Primard, K. (2010). Innovation and knowledge sharing across professional boundaries: Political interplay between boundary objects and brokers. *International Journal of Information Management*, 30(5), 437–444.
- Latour, B. (1987). *Science in action: How to follow scientists and engineers through society*. Cambridge, Massachusetts: Harvard University Press.
- Latour, B. (1988). *The Pasteurization of France*. Cambridge, Massachusetts: Harvard University Press.
- Latour, B. (1993). *We Have Never Been Modern*. (T. by C. Porter, Ed.). Cambridge, Massachusetts: Harvard University Press.
- Latour, B. (1994). On Technical Mediation - Philosophy, Sociology, Genealogy. *Common Knowledge*, 3(2), 29–64.
- Latour, B. (2004). Why Has Critique Run out of Steam? From Matters of Fact to Matters of Concern. *Critical Inquiry*, 30(2), 225–248.

- Latour, B. (2005). From Realpolitik to Dingpolitik or How to Make Things Public. In P. Latour, B. and Weibel (Ed.), *Making Things Public: Atmospheres of Democracy* (pp. 14–41). Cambridge: MIT Press, ZKM, Center for Art and Media.
- Latour, B. (2008). A Cautious Prometheus? A Few Steps Toward a Philosophy of Design (with Special Attention to Peter Sloterdijk). *Design History Society*, 2.
- Lauritsen, P., Jensen, C. B., Olesen, F., Bossen, C., Danholt, P., & Gad, C. (2007). *Introduktion til STS*. (C. B. Jensen, P. Lauritsen, & F. Olesen, Eds.) (1st ed.). Copenhagen: Hans Reitzels.
- Lee, C. (2005). Between Chaos and Routine: Boundary Negotiating Artifacts in Collaboration. *Ecscw 2005*, (September), 387–406.
- Light, A., & Akama, Y. (2012). The Human Touch : Participatory practice and the role of facilitation in designing with communities. *Proceedings of the 12th Participatory Design Conference (PDC '12)*, 61–70.
- Linde, P. (2012). Design and the “Manyness” of Things. In P. Linde, T. Binder, C. Storni, & D. Stuedahl (Eds.), *Exploring ANT in PD: reflections and implications for theory and practice* (pp. 9–10). Roskilde, Denmark: PDC.
- Lindström, K., & Ståhl, Å. (2015). Figurations of spatiality and temporality in participatory design and after – networks, meshworks and patchworking. *CoDesign*, 0882(October), 1–14.
- Marais, S. J., & Shutte, C. S. L. (2009). The Development Of Open Innovation Models To Assist The Innovation Process. In *Innovation In Industrial Engineering, 23rd Annual SAIIRE Conference* (pp. 97–116). Gauteng, South Africa.
- Marcus, G. E. (1995). Ethnography in/of the World System: The Emergence of Multi-Sited Ethnography. *Annual Review of Anthropology*, 24, 95–117.

- Namioka, A., & Schuler, D. (1993). *Participatory Design: Principles and Practices*. (D. Schuler & A. Namioka, Eds.). Taylor & Francis.
- Pascal, A., & Thomas, C. (2007). Role of boundary objects in the coevolution of design and use: the KMP experimentation. 23e *Conférence European Group of Organization Studies*.
- Pedersen, S. (2015). The Sensory Delivery Rooms of the Future: Translating Knowledge Across Boundaries in a Public-Private Innovation Partnership. In *International Conference On Engineering Design, ICED15* (pp. 1–10). Milan, Italy.
- Pedersen, S. (2016). 'Staging Prototyping Spaces' – Navigating boundary objects to interest actors in design processes. Copenhagen.
- Pedersen, S., & Brodersen, S. (2016). Staging Co-design Of Actor-Networks.
- Piller, F., Ihl, C., & Vossen, A. (2011). Customer Co-Creation: Open Innovation with Customers A typology of methods for customer co-creation in the innovation process. In V. Wittke & H. Hanekop (Eds.), *New Forms of Collaborative Innovation and Production on the Internet - An Interdisciplinary Perspective* (pp. 31–63). Göttingen: Universitätsverlag Göttingen.
- Prahalad, C. K., & Ramaswamy, V. (2004a). Co-creating unique value with customers. *Strategy & Leadership*, 32(3), 4–9.
- Prahalad, C. K., & Ramaswamy, V. (2004b). Co-Creation of Value. *The Future of Competition: Co-Creating Unique Value with Customers*.
- Pugh, S. (1991). *Total Design: Integrated methods for successful product engineering*. New York: Addison Wesley.
- Rhinow, H., Köppen, E., & Meinel, C. (2012). Design Prototypes as Boundary Objects in Innovation Processes. *Conference on Design Research Society*, (July), 1–10.

- Rhinow, H., Köppen, E., Moritz, J., Jobst, B., & Meinel, C. (2013). Prototypes for Innovation – Facing the Complexity of Prototyping. *Proceedings of the Cambridge Academic Design Management Conference 2013*, (September), 4–5.
- Sage, D., Dainty, A., & Brookes, N. (2011). How actor-network theories can help in understanding project complexities. *International Journal of Managing Projects in Business*, 4(2), 274–293.
- Sandberg, Å. (1979). *Computers dividing man and work: Recent Scandinavian research on planning and computers from a trade union perspective*.
- Sanders, E. B.-N. (2013). Prototyping For The Design Spaces Of The Future. In L. Valentine (Ed.), *Prototype: Design and Craft in the 21st Century* (pp. 1–8). Bloomsbury.
- Sanders, E. B.-N., & Stappers, P. J. (2008). Co-creation and the new landscapes of design. *CoDesign*.
- Sanders, E. B.-N., & Stappers, P. J. (2014). Probes, toolkits and prototypes: three approaches to making in codesigning. *Codesign*, 10(1), 5–14.
- Sauer, J., Seibel, K., & Rüttinger, B. (2010). The influence of user expertise and prototype fidelity in usability tests. *Applied Ergonomics*, 41(1), 130–140.
- Schoffelen, J., Claes, S., Huybrechts, L., Martens, S., Chua, A., & Moere, A. Vande. (2015). Visualising things. Perspectives on how to make things public through visualisation. *CoDesign*, (October), 1–14.
- Schrage, M. (2006). Cultures of Prototyping. *Bringing Design to Software*, (May), 191–205.
- Schön, D. A. (1984). *The Reflective Practitioner: How Professionals Think In Action*. Basic Books.
- Schön, D. A. (1992). Designing as reflective conversation with the materials of a design situation. *Knowledge-Based Systems*, 5(1), 3–14.

- Shiga, J. (2007). Translations: Artifacts from an Actor-Network Perspective. *Artifact*, 1(1), 40–55.
- Simonsen, J., & Robertson, T. (2012). *Routledge international handbook of participatory design. Public Understanding of Science*. Routledge.
- Soliman, F. (2013). *Learning Models for Innovation in Organizations: Examining Roles of Knowledge Transfer and Human Resources Management*. (F. Soliman, Ed.). IGI Global.
- Spradley, J. P. (1979). Step Two - Interviewing an Informant. In *The Ethnographic interview* (pp. 461–474).
- Spradley, J. P. (1980). *Participant Observation* (1st ed.). Holt, Rinehart and Winston.
- Star, S. L. (1991). Power, Technology and The Phenomenology of Conventions: On Being Allergic To Onions. In J. Law (Ed.), *A sociology of monsters* (pp. 26–56). London, England: Routledge.
- Star, S. L. (2010). This is Not a Boundary Object: Reflections on the Origin of a Concept. *Science, Technology & Human Values*, 35(5), 601–617.
- Star, S. L., & Griesemer, J. R. (1989). Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39. *Social Studies of Science*, 19(3), 387–420.
- Storni, C. (2015). Notes on ANT for designers: ontological, methodological and epistemological turn in collaborative design. *CoDesign*, 11(3-4), 166–178.
- Storni, C., Binder, T., Linde, P., & Stuedahl, D. (2015). Designing things together: intersections of co-design and actor-network theory. *CoDesign*, 11(3-4), 149–151.

- Storni, C., Binder, T., & Stuedahl, D. (2012). Exploring ANT in PD: reflections and implications for theory and practice Workshop at Participatory Design Conference 2012 Exploring ANT in PD: reflections and implications for theory and practice Workshop at Participatory Design Conference 2012.
- Storni, C., Binder, T., Stuedahl, D., & Linde, P. (2012). Exploring ANT in PD: Reflections and implications for theory and practice. In *Workshop at Participatory Design Conference 2012* (pp. 1–47). Roskilde, Denmark: PDC.
- Strauss, A. (1978). A social world perspective. *Studies in Symbolic Interaction*, 1, 119–128.
- Subrahmanian, E., Monarch, I., Konda, S., Granger, H., Milliken, R., & Westerberg, a. (2003). Boundary objects and prototypes at the interface of engineering design. *Computer Supported Cooperative Work*, 12, 185–203.
- Szebeko, D., & Tan, L. (2010). Co-designing for society. *Australasian Medical Journal*, 3(9), 580–590.
- Udbudsrådet. (2012). *Værktøj til Funktionsudbud på vejområdet*.
- Vincent, L. (2008). Differentiating Competence, Capability and Capacity. *Innovating Perspectives*, 16(3), 2.
- Vinck, D., & Jeantet, A. (1995). Mediating and Commissioning Objects in the Sociotechnical Process of Product Design: a conceptual approach. *Designs, Networks and Strategies*, (August), 111–129.
- Vinck, D., & Trompette, P. (2009). Revisiting the notion of Boundary Object. *Revue D'anthropologie Des Connaissances*, 3, 1(1), 3–25.
- von Hippel, E. (2005). Democratizing innovation: The evolving phenomenon of user innovation. *Journal Fur Betriebswirtschaft*, 55(1), 63–78.

- Vaajakallio, K., & Mattelmäki, T. (2007). Collaborative Design Exploration: Envisioning Future Practices with Make Tools. *Design Pleasureable Products and Interfaces*, (August), 223–238.
- Walker, M., Takayama, L., & Landay, J. a. (2002). High-Fidelity or Low-Fidelity, Paper or Computer? Choosing Attributes when Testing Web Prototypes. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, 46(5), 661–665.
- Weihe, G., Højlund, S., & Nørgaard, B. (2012). Offentlig-privat innovation - en ny vej til vækst og bedre velfærd, (6), 1–24.

APPENDICES

The appendices of this summary contain my three articles:

1. The Sensory Delivery Rooms of the Future: Translating Knowledge Across Boundaries in a Public-Private Innovation Partnership
2. 'Staging Prototyping Spaces' – Navigating boundary objects to interest actors in design processes
3. Staging Co-design Of Actor-Networks (together with Søsser Brodersen)

THE SENSORY DELIVERY ROOMS OF THE FUTURE: TRANSLATING KNOWLEDGE ACROSS BOUNDARIES IN A PUBLIC-PRIVATE INNOVATION PARTNERSHIP

Pedersen, Signe

Aalborg University, Denmark

Abstract

One of the biggest challenges when co-designing new and innovative products, services or systems is to handle the different knowledge perspectives of the involved project partners. In design and innovation processes the ability to translate knowledge across knowledge boundaries by enrolling actors and building up stable networks is crucial for success. Transferring knowledge across functions within the same company, has proved to be a problem, however, this might be an even bigger issue when it comes to Public Private Innovation Partnerships (PPIs), where the project participants (both the selected representatives and their organisations) might have very different backgrounds, incentives and motivations for participating in the design project.

This article is following the partners involved in a successful PPI, in their efforts to design 2 sensory delivery rooms at a Hospital in Denmark. The research revolves around the efforts of the lead designer from one of the private companies in building up the network around the new Sensory Delivery Rooms by drawing on previous experience and using various boundary objects at different stages in the design process.

Keywords: Design process, Innovation, Participatory Design, Knowledge management

Contact:

Signe Pedersen

Aalborg University, Copenhagen

Department of Development and Planning

Denmark

sigpe@plan.aau.dk

Please cite this paper as:

Surnames, Initials: *Title of paper*. In: Proceedings of the 20th International Conference on Engineering Design (ICED15), Vol. nn: Title of Volume, Milan, Italy, 27.-30.07.2015

1 INTRODUCTION

The challenges and difficulties of handling different knowledge perspectives in complex design and innovation processes have in recent years been widely addressed in the literature. STS researchers points to the fact that, knowledge in innovation processes is used to build up and stabilise heterogeneous actor networks through translation processes (Akrich et al., 2002), and also authors from other scholarly disciplines highlight the importance of knowledge as a critical factor for the success of innovation processes (Nonaka and Takeuchi, 1995).

Studies have shown, that the challenges of handling various types of knowledge become evident when knowledge is shared across boundaries of functions, professions etc. (Carlile, 2004; Carlile, 2002). One way to span such knowledge boundaries is to use objects as a way to engage heterogeneous actors in a mutual dialogue. Within the American pragmatism tradition, authors such as Star and Griesemer (1989) and later Carlile have introduced and built on the concept of 'boundary objects' and their use, describing the characteristics of 'objects' that can be shared, negotiated and discussed across knowledge boundaries in different contexts. While Carlile focuses on knowledge boundaries between professional functions within companies, the design literature addresses knowledge sharing across boundaries between actors from different companies and entities (Gunn and Clausen, 2013) and across different competencies (Brandt, 2007).

Inspired by the translation perspective from Actor Network Theory (Callon, 1986), this article analyses the boundary spanning activities of translating knowledge across boundaries using diverse boundary objects. The specific backdrop of this analysis is Public Private Innovation Partnerships (PPIs) in a Danish healthcare setting. Denmark strives to be forerunners in developing and providing new services to support the Danish welfare state and to export products and services globally. The PPIs are currently seen as means for doing just that, as it is believed that collaboration between actors who are to interact with the technology, and developers of the technology, is bound to result in successful, innovative solutions. Building on this idea and understanding, in 2012 a PPI was initiated by the midwives of Hillerød Hospital in the Capital Region of Denmark, with the aim of designing two new flexible and relaxing Sensory Delivery Rooms.

The focus of the analysis revolves around the types of knowledge at play in this partnership, as it is somewhat representative of challenges encountered in similar PPI projects within a healthcare setting as well as in multi-disciplinary innovation projects in general. Special attention will be paid to how the different types of knowledge are translated across knowledge boundaries, using different boundary spanning objects, to build and stabilise a network of actors in a co-design process.

2 KNOWLEDGE IN INNOVATION PROCESSES

2.1 Sharing knowledge across boundaries

According to Carlile (2002), knowledge cannot readily be transferred directly from one function within a company to another (e.g. from R&D to marketing or sales). Instead it needs to be transformed and negotiated so both e.g. R&D and marketing can relate this knowledge to their own practices and professional language. This transformation of knowledge is exactly what is at stake in design and innovation processes, as design is about transforming and questioning existing knowledge, while building up stable networks around the new concept. Carlile introduces boundary objects as a tool to make this transformation happen, and highlights three characteristics that make a boundary object useful to communicate across knowledge boundaries: 1) the establishment of a shared syntax, 2) the ability to discuss different meanings and 3) facilitation of the process of jointly transforming knowledge. All 3 characteristics supports communication and knowledge sharing, however, since the transformation of knowledge has proved to be key in design processes and network building, the types of boundary objects supporting this transformation are of particular interest here. Mock-ups and prototypes are examples of such boundary objects that give meaning and makes sense to different actors in spite of their diverse professional practices and professional languages (Brandt, 2007; Rhinow et al., 2012). The fidelity and detail of such mock-ups and prototypes varies during the design process as the initial mock-ups such as hand drawings may be open to interpretation while the final

prototype is much more detailed and difficult to change. In both cases the materiality of such mock-ups gives the different actors something concrete and somewhat tangible to comment on and engage in. This paper will provide insight into how different types of boundary objects come into play in the design of the sensory delivery rooms at Hillerød Hospital.

2.2 Innovation as network formation

In the science and technology (STS) literature innovation is seen as network formation where the network is built and stabilised through the enrolment and mobilisation of allies to speak and act on behalf of the network. *"Innovation is perpetually in search of allies. It must integrate itself into a network of actors who take it up, support it, diffuse it."* Also *"Innovation is the art of interesting an increasing number of allies who will make you stronger and stronger."* (Akrich et al., 2002: 203, 205)

Network formation plays an evident role in PPIs where heterogeneous actors from very different sectors and domains are to build up a common network. The process of enrolling and mobilising actors in building up the network, is often referred to as a process of translation, which consist of 4 strands: *problematization* (a problem/agenda is set forth), *interessement* (actors become interested in joining the network and starts negotiating the terms of their enrolment), *enrolment* (the roles of the actors are defined and interlinked) and *mobilization* (the actors actively work for the networks agenda) (Callon, 1986). This concept of translation builds on Carlile's (2002) concept of transformation by adding the concept of the actor network of practice that is part of this transformation (Chen and Huang, 2009). Hence the term 'translation' will from here on be used to cover both transformation and translation.

When going through the network building process of the Sensory Delivery Rooms, it is important to notice, that not all actors are enrolled in the same way. They each have their own motivations and incentives to be part of the project, and hence not all actors are enrolled based on the same types of arguments. My research points to the fact that some types of knowledge count more for certain actors than other types do. In the medical domain quantitative knowledge based on Randomised Control Trials (RCT) plays a crucial role, because the hospitals ask for solutions that have been thoroughly tested and validated. Turning to a quite different domain found in creative design companies, qualitative knowledge represented by e.g. drawings of patient flows and user quotes, is perceived to be more valuable. Needless to say, the merging of these knowledge domains, which is supposed to happen in PPIs, often proves tricky.

3 ENROLLING ACTORS IN CO-DESIGN PROCESSES

3.1 Participatory Design and Co-Design

PPIs are framed as a co-design process where the users of the technologies/concepts are involved in the design phase. Co-design activities can be traced back to the Scandinavian participatory design tradition, which is based on inclusion and democracy and has its roots in the 70's workers movement, where actors from the professions were taken into account and invited to influence the design of their work environments. (Sanders and Strappers, 2008). Sanders and Strappers have proposed the following definition of co-design, which is comparable with the situation seen in PPIs: *"We use co-design in a broader sense to refer to the creativity of designers and people not trained in design working together in the design development process."* (Sanders and Strappers, 2008: 6) This definition stands in opposition to the user-centred design approach where focus is on studying the users to discover and identify their unarticulated needs (Jensen, 2012). Also the authors carefully mention 'people not trained in design' instead of 'users' which is very much in line with STS describing 'a network of actors' and not only the users. PPIs are configured to involve actors from the public sector, who eventually is to be one of the main 'users' of the product, service or system to be designed. Hence, they are involved throughout the design process – also in the initial framing, staging and problematization of the project.

3.2 Framing and Staging the design process

Some authors argue that insights from political process theory can contribute to a reflexive understanding of design as the staging of socio-technical relations (Clausen and Yoshinaka, 2007). From a design perspective, ‘staging’ is used to illustrate how a project or activity is framed in terms of bringing together or connecting actors and perspectives in a design process by the means of different material objects and facilitation. The concept is inspired by the theatre metaphor, where you invite selected actors on the stage to enact existing frames of understanding, to selectively frame problems, solutions, events, and enact circumstances and conditions using props such as design games or mock-ups. Creating reflective conversations and interactions between participants and objects and then enacting stories of future use is seen as “*ways to put the design and arrangement of space, scenery and props, the staging, into play*” (Clausen et al., 2012: 2). In PPIs the projects are framed and staged very explicitly to bring together public and private organisations as part of the premise. However, from the beginning of these projects it is not at all explicit, which problems to frame and which props to use during the project. In some PPIs in Denmark groups containing a mix of public and private organisations have been formed based on the assumption that new innovations will automatically, once you connect people and organisations to one another – but so far none of these has succeeded. The story about the design of the Sensory Delivery Rooms provides insights into how the framing and staging of the process was the basis of the project’s success.

3.3 Public Private Innovation Partnerships in a Danish context

The actors involved in PPIs in a Danish healthcare context, are private companies developing e.g. hospital equipment and public organisations, which could be hospitals. The general idea is that the public entities, here the hospitals, have a problem or a need for new solutions, and that the private companies have the expertise and the capacity to design these new and innovative solutions which solves the initial problem. Under normal circumstances the laws of public procurement rules out the private company as ineligible in the following tender process if they have collaborated with the hospital in development activities. In a PPI setup, however, this is not the case because the projects are defined as smaller pilot development projects. Hence the PPIs are arranged as pilot projects, later to be scaled up and sold to hospitals in Denmark and globally (see Figure 1).

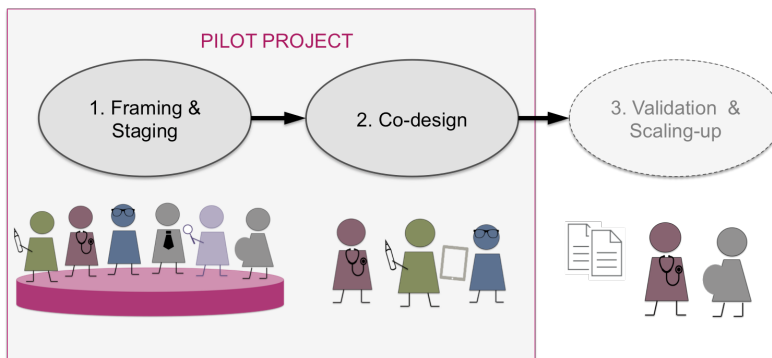


Figure 1. Illustration of the different stages of a PPI and the key activities within these

To date, more than 250 PPIs has been initiated in Denmark, and this particular PPI is one of the only ones where all project participants (both public and private) agree that it has been successful. Previous projects have proved successful for either the public *or* the private project participants and in some cases for none of the above. The following description will allow for further analysis of what made this particular project a success.

4 CO-DESIGNING THE DELIVERY ROOMS OF THE FUTURE

4.1 Framing and staging the PPI process

What follows is a look into the framing and staging, and hence the initial network building activities, of the co-designed new intervention at Hillerød Hospital.

The maternity ward at Hillerød Hospital was facing a project of building 9 new delivery rooms due to restructuring. In this process the midwives, who are the main ‘users’ of the delivery rooms working there every day, articulated a wish to have the rooms individually decorated to remove the clinical feeling they evoked and instead create a more relaxing environment for the women during delivery. Studies suggest, that fewer complications arise and less medicine is given when the woman is not too stressed and anxious. Also, when the women are more relaxed, the midwives can spend more time enhancing the experience by using her professional experience rather than comforting the woman. The midwives wished for a tranquil atmosphere to support their work and relax the women giving birth, but the delivery rooms also needed flexibility to accommodate different work practices. E.g. it was essential that the these ‘special’ delivery rooms could immediately be transformed into a ‘normal’ delivery room if any complications was to arise, and it was important that the equipment was standardised so the staff would not have to use time trying to locate different instruments during such occurrences.

With these initial thoughts and wishes, the midwives approached an innovation consultant situated at Hillerød Hospital who’s job was to initiate new PPIs. The project was of immediate interest for the consultant as this proposal was in perfect line with the new hospital strategy to attract more women to deliver here as well as to provide inspiring surroundings to attract new, motivated staff to the department. The idea that a relaxing atmosphere would lead to fewer complications during the delivery process corresponds to what Callon (1986) would term the *problematization* strand of translation in the building up of a new network. The midwives, the hospital management and the innovation consultant each had their own motives for being interested in the problematization and so did the companies once approached.

Not surprisingly, networking and having a good reputation in the industry, is of huge significance when it comes to being invited to participate in PPIs. The innovation consultant from Hillerød Hospital had previously been involved in another PPI together with the small Danish design company Wavecare, that develops audio-visual interventions related to healthcare, and hence Wavecare was invited into the PPI based on this previous reference and their track record of working with relaxation in healthcare settings. Being a small and visionary company Wavecare are always interested in engaging in new design activities to gain novel knowledge to be used in future projects. Also Wavecare are well aware, that if they get the reputation of being a company that makes things happen, they immediately get good references, and are more likely to be invited into new project constellations in the future. Wavecare had on previous occasions worked with Philips, who is a strong player in the design and development of healthcare technologies and ambient experience. Philips had the innovative technology, which could potentially play a significant role in the final concept, namely the luminous textile invented by researchers at the Philips headquarters in Eindhoven, Netherlands. The luminous textile is a backlit ‘screen’ covered with textile that provides a somewhat blurry, low-resolution image of moving pictures. Being inventors of the luminous textile, and developers of lighting solutions, meant, that Philips was an obvious project participant. However, in this particular project Philips took on the role of supplier of the technology rather than designing the full intervention, which would normally be the case. Even though Philips in Eindhoven has many designers specialised in healthcare, it was a lighting designer and a key account manager from Denmark who became involved in this project because of the Danish context. Philips saw it as a nice opportunity to further develop the luminous textile and of being ‘visible’ in the Danish healthcare landscape to position themselves as providers of new solutions for the many super hospitals currently being build.

The innovation consultant from Hillerød hospital also knew Philips well and she thought that Philips and Wavecare would form a nice combination of expertise, experience and hardware and so the project team came to count one public and two private organisations. These were the parties selected to engage in a co-design process of the new delivery rooms, and the activities described above can be seen as part of the *interessement* where the involved parties agree that the concept should consist of light, sounds, and images on the luminous textile.

The rather heterogeneous actors constituting the network have different identities and motives (see Figure 2). Together these more or less articulated motivations form a collection or list of criteria (the *obligatory passage point*) that the concept should encompass to strengthen and stabilise the network. At this point, the innovation consultant has managed to interest Philips and Wavecare in the network, and hence she had reached her goal and was no longer part of the project.

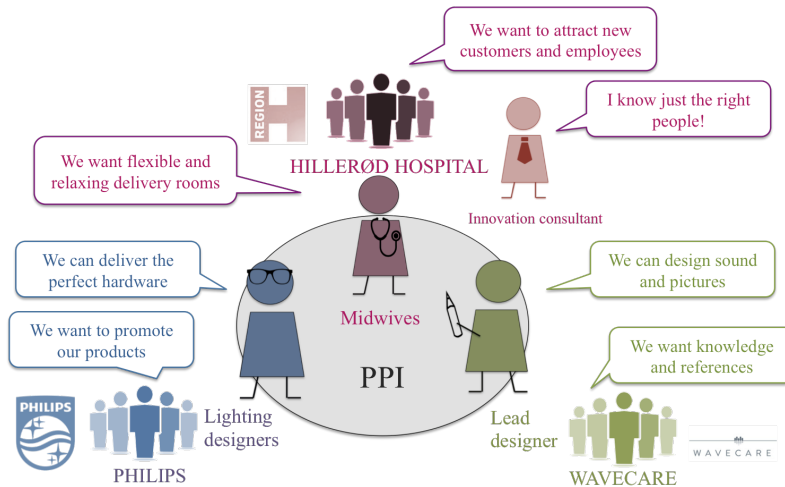


Figure 2. The PPI setup and the motivations and roles of the actors in the network

4.2 The vision of the Designer translates knowledge

One of the key actors in this project is the lead designer from the small Danish design company Wavecare. A few months before being asked to participate in the PPI, he was invited to Eindhoven by Philips to witness the unveiling of the new luminous textile. When introduced to this innovative technology, the lead designer immediately felt that it would be perfect for creating a peaceful atmosphere, and saw the project of designing the delivery rooms at Hillerød Hospital as a golden opportunity for doing exactly that. His vision was, that the luminous textile, in combination with his knowledge and skills in terms of audio-visual interventions, would make a perfect concept to match the wishes and ideas of the midwives of a calming and supportive delivery room. At one of the initial face-to-face meetings the lead designer presented his ideas to the midwives and to Philips by showing them a mock-up of the concept on his computer, to illustrate how it would look in the context of the new delivery rooms.

This mock-up served as a boundary object as it was concrete or robust enough for everyone to grasp the meaning, and 'plastic' enough for it to adapt to different contexts and knowledge domains (Star and Griesemer, 1989). Everyone was impressed by what they saw, and immediately all was on board with the overall idea. The visualisation of a concept in a use context represented a concrete solution that everybody could convey, as they could relate this idea to their own practice and motivations/incentives for participating in the project. Hence this particular concept became the solution to span organisational boundaries and knowledge domains. The designer draws on knowledge from previous experiences as well as on his knowledge about the luminous textile and translates this knowledge into a concept, relevant for this particular setup, because it speaks to all of the involved actors. Furthermore, the designer has dealt with public health institutions before related to the same topic of relaxation in stressful situations and environments, which enables him to speak the professional language and hence, *enrol*, and *mobilise* both the midwives and Philips to each contribute to and stabilise the network. The midwives provide insights, Wavecare design the solution and provides sound and images and Philips supply the hardware.

4.3 Detailing the intervention - and the difficulties of enrolling the luminous textile

From this point on, the character of the project shifted towards focusing on detailing the agreed concept. Rooted in experiences and work practices of the midwives, three different 'programs' was developed and introduced to support the delivery process: a welcoming program, a relaxation program and a breathing program. The development of these programs had an iterative nature where the midwives explained to Philips and Wavecare what was important to them in their work and to the women in labour, and between meetings the companies would go back to the drawing board, and come up with sub-solutions to improve the concept accordingly.

It seems as if all involved actors was enrolled in the network at this point in time, as each plays their well-defined part. However one actor was still only in the process of being enrolled: the luminous textile. When the lead designer initially presented the computer-based mock-up, both the midwives and Philips was enthusiastic, and trusted the designer to make the concept work in a real life setting. The first time a prototype of the installation was introduced to all project participants, was at a health care conference in Copenhagen. When the installation was turned on and revealed for the first time, the disappointment was very readable in the faces of the midwives. The real-life use of the luminous textile was not as easily handled as initially thought and planned. This was a crucial setback, and the lack of corporation from the luminous textile almost broke the entire network down. However, the lead designer went back to his workshop and re-designed the programs to fit the concrete, real-life luminous textile, and eventually came up with a solution that satisfied the wishes of the midwives and restored their trust in the designer as well as in the luminous textile. The crisis was averted and the network remained stable.

Already in the beginning of the project, all three partners felt strongly about rapidly installing a working prototype at the maternity ward to quickly see the fruits of their collaboration. This prototype eventually served as an even more tangible boundary object than the mock-up, and gave the midwives the opportunity to see how the intervention would work in practice and enabled them to suggest improvements. Also the speedy introduction of a working prototype would initiate the testing and hence the validation of the concept, which was essential in order to enrol and satisfy the buyer (the hospital management) who are mainly valuing quantitative data. This was an interesting moment in the project, as a 'new' actor was to be interested and enrolled in the network around the Sensory Delivery Rooms – the women giving birth. Until now the midwives had represented them throughout the design process, but now they were interviewed and asked to give feedback by filling in questionnaires to comment and rate their experience.

4.4 Installation, modification and test of the intervention

However, before starting the validation process the prototype was to be tested and adjusted accordingly. The luminous textile, the lights and the sound were installed at two Sensory Delivery Rooms, and the prototype was initially tested for two weeks. Then the concept was evaluated and re-designed based on the chosen midwives experiences using the rooms. After the trial period it was clear to the midwives that several changes had to be made. The breathing programme, to support the women breathing correctly during contractions, included visuals on the luminous textile of waves rolling onto a beach at a specific pace and frequency. However, this frequency was so quick, that it took the breath out of *any* woman in labour. Hence the lead designer went to another beach and shot new footage of different waves, and then sat in his workshop trying to breathe like a woman in labour to match breathing and footage until it was just right.

Furthermore there was video of a cosy, burning bonfire on the luminous textile, which was nice and calming for the women in labour and her relatives. However, this artificial bonfire made the light in the room flicker immensely and consequently it became almost impossible for the midwives to concentrate and focus. Once again the lead designer went back to his workshop and adjusted his work to match the expectations of the midwives. This iterative process of optimising and re-designing the intervention to fit the on-going practices in the delivery rooms, proved challenging for the Philips representatives. They were eager to finish the process as they had already spent all the time allocated to this project by the Philips organisation. As Philips in Denmark do not usually focus on design, employees are normally evaluated, and their performance measured, by how many light fixtures they sell and not by how much new knowledge they contribute to the organisation by participating in new

and interesting design activities. This challenged the iterative nature of the process and the stability of the network, as Philips pushed for the final design to be decided upon as quickly as possible. Eventually the midwives felt very satisfied with the modifications and optimisations and started evaluating and measuring the indicators they knew were important to validate the impact of the installation. In total 102 women were randomly chosen to participate in the evaluation process, answering questionnaires producing quantitative data, and participating in qualitative interviews. The result of this evaluation process was published in a report, which came to serve as a boundary object where the midwives and the women were represented by both quantitative and qualitative data. The combination of statistics and quotes made the result very robust and enabled the report to 'speak' to different actors such as hospital managements, nurses and pregnant women in a process of deciding on which hospital to give birth. 95% of the women who had delivered their babies in the Sensory Delivery Rooms was very happy with the experience, and this quantified information contributed to the strengthening and stabilisation of the network and the success of the project.

5 DISCUSSION – REPRESENTATION AND TRANSLATION OF DIFFERENT TYPES OF KNOWLEDGE

So what made this PPI a success for the midwives, Philips, Wavecare and for the women giving birth altogether? There are several explanations. First of all, the midwives, who are also the main users of the Sensory Delivery Rooms, had articulated a problematization, which focused on a concrete desire for flexible and calming delivery rooms. Secondly, the lead designer was able to speak the professional language of both Philips and the midwives, which helped him in his efforts to handle and translate both qualitative and quantitative knowledge during the project. And thirdly, boundary objects with varying types of fidelity and detail allowed for shared understandings and specific negotiations of the concept. These 3 elements deserve further elaboration.

5.1 Involvement of the primary users throughout the co-design process:

This PPI project was indeed a co-design process according to the definition introduced by Sanders and Strappers (2008) presented in the beginning of this article. The project was framed and staged to ensure active involvement of the midwives throughout the design process from problem identification, through conceptualization, and to evaluation and testing of the final installation. The midwives initiated the project and put forward an agenda, which provided the focus of the project. They also acted as experts in their own work practices at the maternity ward, and worked together with a trained designer in the design process, although not being designers themselves. The iterative nature of the involvement of the midwives truly qualified the designs put forward by the lead designer from Wavecare and by the Philips employees. This indeed illustrates the value of actively involving actors who are not trained designers in a co-design process.

5.2 Handling different types of knowledge to translate the network:

As the case have illustrated, the handling of diverse types of knowledge is a valuable skill in the process of co-designing with actors from very different backgrounds and professions. The lead designer had previously worked with both Philips and healthcare professionals, so he was accustomed to the syntax or language used by the midwives, as well as the business jargon of Philips, which eased the sharing of knowledge (Carlile, 2002)

Both qualitative and quantitative knowledge is equally important but may be used in different ways and at distinctive stages in the design process. Already from the beginning of the project, qualitative knowledge in the form of statements and explanations from the midwives about their work practices and experiences, were translated into the three different programs of light, sound, and image by the designer and Philips. This particular knowledge was available to the designer because the midwives were active co-designers in the process. Later on quantitative knowledge came into play, as the concept was tested and validated by the midwives and the women giving birth. Being able to statistically 'prove' that the concept indeed supports the work of the midwives and makes the delivery process a nice experience for the women and her relatives is paramount in the scaling up activities following the pilot project.

Based on this case, it seems that qualitative knowledge is of particular relevance in the beginning of the project whereas qualitative knowledge becomes essential by the end of the project, because it involves communicating knowledge between different types of actors with different motivations.

5.3 Boundary objects as a means to facilitate translation of knowledge and co-design:

Neither qualitative nor quantitative knowledge is readily translated into the design process to build up the network. But this case also illustrates how different types of boundary objects enable dialogue and translation of knowledge to heterogeneous actors with diverse motives, during different stages in the design process. The midwives want a concept that supports their work, and are able to give qualitative inputs to the design process. Once the pilot project is in its final phases, there is an increasing focus on scaling up activities. Philips wants to validate their products so they can sell them to the hospital management who also values quantitative data, and Wavecare want to have a good track record and hence nice references for future projects (see Figure 3).

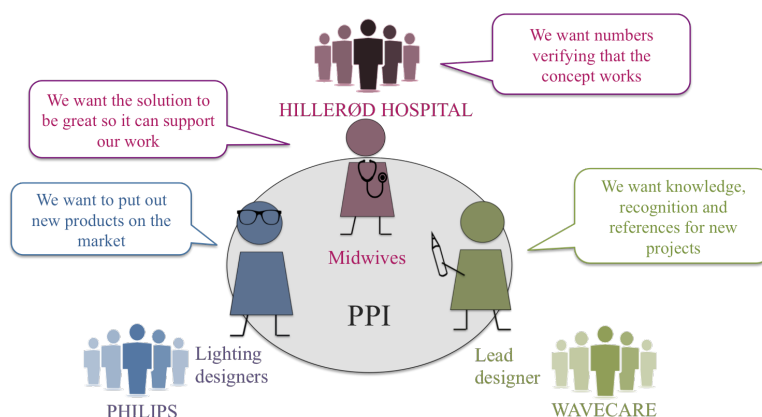


Figure 3. Each actor has different motivations and values different knowledge

Different types of boundary objects satisfy the diverse motivations and identities of the actors:

1. The hands-on knowledge and experiences of the midwives are translated into three programmes to support the midwives in their work and the woman during delivery.
2. Knowledge and ideas are shared in face-to-face meetings with mock-ups e.g. illustrations of how the intervention would present itself visually and how it would work.
3. Ideas and knowledge are quickly translated into a working prototype to illustrate the proof of concept and serves as a basis for the study of testing and validating the intervention.
4. The evidence provided by the final study and the report is needed for scaling up purposes.

During the initial face-to-face project meetings, the qualitative 'hands-on knowledge', embedded in the practices of the midwives, was explained by the midwives and then translated into the concept of 3 supportive programmes by the lead designer from Wavecare.

In the co-design process, mock-ups and the working prototype was used as boundary objects which often united the project participants making the network stronger, while at other times almost broke the network down. The computer based mock-up made all project participants see the vision of the lead designer, but it did not contain the materiality and hence the properties of the initial prototype presented at the conference proved to be a big disappointment, and made the other participants momentarily doubt the designer and his visions.

For scaling-up purposes the evidence-based knowledge is crucial. The report based on this study will eventually be the ultimate boundary object that speaks directly to the hospital managements and potentially persuades them to buy the solution so that scaling-up activities can begin and more hospitals can benefit from the concept.

We see an evolution with the boundary objects as they start as rough mock-ups on a computer and eventually increases in fidelity and detail towards the concrete prototype installed in the delivery rooms. This illustrates that the requirements to the boundary objects, change throughout the design process to support the different phases and the type of knowledge present. In the beginning they should open up for new ideas and concepts and eventually be very tangible so they can be tested and the final iterations and improvements of the concept can be done.

6 CONCLUSION

We know it is difficult to cross knowledge boundaries in co-design processes, but also that it can be done. The case of the Sensory Delivery Rooms exemplifies how there are different motivations and types of knowledge at stake for the involved actors in a design process, which means, that they, need to be addressed and translated in different ways to build a stable network. This case has also illustrated how boundary objects can support this translation process, and that the nature of boundary objects changes during the design process to become increasingly tangible, detailed and relatable according to the knowledge needed by the heterogeneous actors.

Furthermore, the PPI setup encourages involvement of the main user throughout the design process. Obviously involvement of main actors in design processes is not unique for PPIs but is likewise seen in many other project constellations. In most co-design processes different types of knowledge will need to be shared and translated between people from different professions and with different motivations. Even though PPIs in healthcare settings are quite particular, I will argue, that the handling and sharing of both qualitative and quantitative knowledge is also relevant in other contexts as well, and that boundary objects such as mock-ups and prototypes can play a valuable part in all co-design processes where knowledge is shared and negotiated.

REFERENCES

- Akrich, M., Callon, M., Latour, B. and Monaghan, A. 2002, "The key to success in innovation part I: the art of intersement", *International Journal of Innovation Management*, vol. 6, no. 02, pp. 187-206.
- Brandt, E. 2007, "How Tangible Mock-Ups Support Design Collaboration", *Knowledge, Technology and Policy*, vol. 20, no. 3, pp. 179-192.
- Callon, M. 1986, "Some elements of a sociology of translation: Domestication of the Scallops and the fishermen of St Brieuc Bay" in *Power, Action and Belief: A New Sociology of Knowledge*, ed. J. Law, Routledge, London, pp. 196-223.
- Carlile, P.R. 2004, "Transferring, translating, and transforming: An integrative framework for managing knowledge across boundaries", *Organization science*, vol. 15, no. 5, pp. 555-568.
- Carlile, P.R. 2002, "A Pragmatic View of Knowledge and Boundaries: Boundary Objects in New Product Development", *Organization Science*, vol. 13, no. 4, pp. 442-455.
- Chen, C. and Huang, J. 2009, "Strategic human resource practices and innovation performance - The mediating role of knowledge management capacity", *Journal of Business Research*, vol. 62, no. 1, pp. 104-114.
- Clausen, C., Pedersen, S. and Yoshinaka, Y. 2012, "Facilitating and navigating user knowledge in an organizational context", *12th Participatory Design Conference*, pp. 41.
- Clausen, C. and Yoshinaka, Y. 2007, "Staging socio-technical Spaces: Translating across boundaries in design", *Journal of Design Research*, vol. 6, no. 1-2, pp. 61-78.
- Gunn, W. and Clausen, C. 2013, "Conceptions of innovation and practice: Designing Indoor Climate", *Design Anthropology: Theory and Practice*, Gunn, W., Otto, T. and Smith R.C., eds, , pp. 159-179.
- Jensen, T.E. 2012, "Intervention by Invitation", *Science Studies*, vol. 25, no. 1, pp. 13-36.
- Nonaka, I. and Takeuchi, H. 1995, *The knowledge-creating company: How Japanese companies create the dynamics of innovation*, Oxford university press.
- Rhinow, H., Köppen, E. and Meinel, C. 2012, "Prototypes as Boundary Objects in Innovation Processes", *Conference Paper in the Proceedings of the 2012 International Conference on Design Research Society (DRS 2012)*, pp. 1.
- Sanders, E. and Strappers, P.J. 2008, "Co-creation and the new landscapes of design", *CoDesign*, vol. 4, no. 1, pp. 5-18.
- Star, S.L. and Griesemer, J.R. 1989, "Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39", *Social Studies of Science*, vol. 19, pp. 387-420.

STAGING PROTOTYPING SPACES: NAVIGATING BOUNDARY OBJECTS TO INTEREST ACTORS IN DESIGN PROCESSES

Pedersen, Signe

Aalborg University, Denmark

Abstract

In the past 15 years, there has been an increasing interest in the industry to open up product development activities and actively engage in co-creation activities with users, clients, and business partners. However, involving various actors in design processes is often challenging for designers and engineers, and calls for negotiation and navigation across 'knowledge boundaries' between the designers and the actors they are attempting to involve. Prototypes designed to perform as boundary objects in temporary 'spaces' for innovation, seem to be a way to accomplish this navigation, however, the current literature on prototypes and Participatory Design lacks a navigational concept to help sensitise how the designer navigates prototypes across space boundaries. In this article, I will propose the concept of Prototyping Spaces and through an exploratory case study in an industrial setting use Prototyping Spaces to shed new light on the role of prototypes. The concept of Prototyping Spaces supports the practitioners' understanding of how to navigate innovative instances of prototypical boundary spanning. It also adds to the prototyping and Participatory Design literature in terms of introducing a navigational concept, which appreciates and analyses prototypes in an emerging/changing context and highlights the transformative nature of prototypes as Boundary Objects.

Keywords: Participatory Design, Actor-Network Theory, Staging, navigation, Prototyping Spaces

1 INTRODUCTION

The aim of this article is to analyse how designers and engineers can navigate prototypes as a means to span knowledge boundaries between themselves and the diverse actors from the value chain they are to engage during different moments in the design process. Firstly current theoretical approaches forming the basis of this analysis are presented. Next I introduce a new sensitising concept called Prototyping Spaces, which is eventually used for analysing a case study about the design work done by a major international electronics company designing market leading medical equipment and electronic consumer products to hospitals and consumers around the world.

1.1 Co-creation in Open Innovation

During the past 10-15 years an increasing number of companies worldwide has publicly committed themselves to the management strategy Open Innovation (Chesbrough, 2006). This has led to a growing interest among practitioners and scholars, addressing and analysing how companies engage with multiple, diverse stakeholders as part of their product development activities (Brown & Wyatt, 2010; Chesbrough, 2006; Enkel et al., 2009; Marais & Shutte, 2009; Piller et al., 2011). The electronics company analysed in this article, has opened up their development activities, and explained this transition process as essential to the way they currently develop new products, services and systems. Before their transition towards Open Innovation, internal designers and engineers developed new technological solutions behind closed doors at the company premises, to protect their ideas from competitors. The firm driven strategy of opening up to collaboration and interaction with partners from other industries, public organisations, customers, end-users, and other actors from the value chain, allows for an encompassing source of external knowledge. Especially involvement of the ‘customers’ (or end-users) is one of the fundamental sources of information for innovation, and the type of Open Innovation where customers are actively involved in designing a new product, service or system has been labelled ‘co-creation’ (Piller et al., 2011; Prahalad & Ramaswamy, 2004a, 2004b). Customer co-creation is based on the premises that end-users themselves are able to come up with innovative ideas. E.g. ‘lead users’ (von Hippel, 2005) might design new products ahead of market needs, idea competitions are called by companies and won by customers presenting the best ideas, and ‘hackatons’ are called to encourage participants in cross-disciplinary teams to generate new ideas in facilitated workshop settings (Marais & Shutte, 2009).

1.2 Using mock-ups and prototypes to involve users in Participatory Design

Customer co-creation is, however, not the only way to obtain valuable inputs from users in the design process. Actually, co-creation draws upon the landscape of Participatory Design, initiated in Scandinavia in the 1970's (Gregory, 2003; Sanders & Stappers, 2008). Participatory Design aims to enhance democracy and change by inviting the people who are going to use the product or solution to play a critical role in designing it (Gregory, 2003; Namioka & Schuler, 1993). However, though Participatory Design has been around for a while, the industry has not yet fully embraced this approach. Perhaps because Participatory Design has been criticised of being an academic endeavour too focused on development of methods and too far from the 'market' (Buur & Matthews, 2008). With their concept of Participatory Innovation, Buur and Matthews draws on elements from both Participatory Design and co-creation. This combination maintains the industry focus on markets, while including and using methods from Participatory Design to involve, not only end users, but a whole *range* of different people in the design process (ibid.). In line with the concept of Participatory Innovation, I will use the word 'actors' to cover the various stakeholders involved, engaged and interested in a design project.

When companies start opening up to various actors, such as customers, end-users, suppliers and business partners, it becomes increasingly important to communicate and negotiate knowledge across professional and cultural knowledge boundaries (see figure 1). Hence sharing knowledge across company divisions, with business partners, and with end-users, often proves difficult and calls for so-called 'boundary spanning activities' (Carlile, 2002, 2004; Kimble et al., 2010; C. Lee, 2005; Vinck & Trompette, 2009).

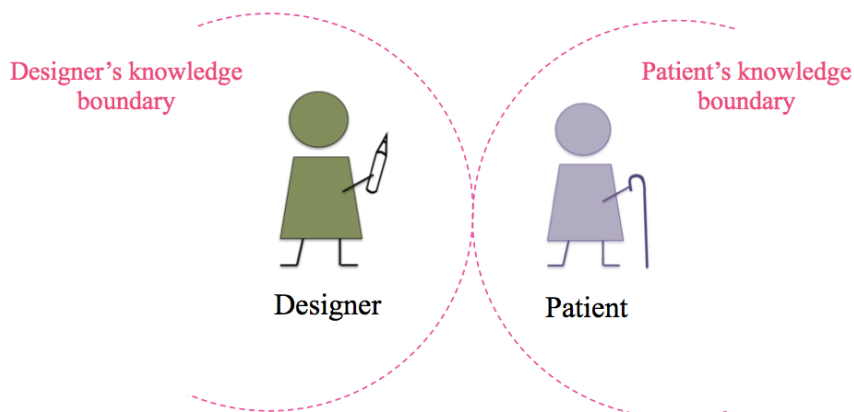


Figure 1: Illustration of encounters between two knowledge boundaries

One of the key methods of engaging actors and sharing knowledge in the fields of Participatory Innovation, Participatory Design and Engineering Design, is to use representations such as mock-ups and prototypes in the interaction and dialogue with different actors (Brandt, 2007; Buur & Matthews, 2008; Kensing & Blomberg, 1998; Kensing et al., 1998). In both engineering companies and software development, prototypes and mock-ups have been used to embody and represent new ideas and visions to be shared amongst the project team (Henderson, 1991; Rhinow et al., 2013; Schrage, 2006). Also prototypes are used to share knowledge between designers/engineers and other actors e.g. when testing high fidelity prototypes (Björgvinsson et al., 2012). However, neither the co-creation nor the Participatory Design literature describes which aspects an engineer or designer should keep in mind when designing and navigating the prototypes to span knowledge boundaries. Therefore, we turn towards the prototyping literature for prospective answers before going into detail with prototypes as potential boundary objects.

1.3 Prototypes as representations of ideas

Designers, architects and engineers have traditionally used different visual representations and embodiments such as drawings, prototypes, and models to represent e.g. future products or buildings (Blomkvist & Holmlid, 2011a). Prototypes are often referred to as representations of *ideas* (Blomkvist & Holmlid, 2011a; Houde & Hill, 1997; Rhinow et al., 2012, 2013), used in various ways during a design process, and for different purposes. Especially four prototype-characteristics influences an interaction: format, fidelity, purpose, and moment in design process.

1.3.1 Format

The format used to represent ideas is somewhat dependent of the tradition within the specific field. Within software development hand-drawn storyboards are often used to represent an early idea of how to navigate a new User Interface (UI), architects have always build cardboard or foam models of future buildings, while engineers have traditionally used prototypes to represent and test the first of a kind of a product (Sanders, 2013).

1.3.2 Fidelity

The fidelity of a prototype refers to the level of detail or refinement of a prototype, and indicates how much the prototype resembles the finished product (Blomkvist & Holmlid, 2011a). In some industries and companies the term ‘prototype’ is thus associated with high fidelity, and close-to-launch, models of a product build late in the design process (Blomkvist & Holmlid, 2011a; Coughlan et al., 2007; Sanders, 2013; Zomerdijs & Voss, 2010). However, especially within design domains (such as interaction design) prototypes are increasingly introduced earlier in the design process to test possible futures and gain new insights from different actors. The advantages of this approach are low costs and easy modification of the idea and the prototype (Blomkvist & Holmlid, 2011a; Coughlan et al., 2007). In general, the fidelity of a prototype is closely interlinked with the purpose.

1.3.3 Purpose / Intention

There are many different purposes of building prototypes. The prototypes tend to be rough and low-fidelity in the beginning of the design process to encourage exploration, out-of-the-box thinking, and allow for major changes based on inputs from involved actors. Towards the end of the design process the prototype typically is high-fidelity and detailed to allow for smaller adjustments and adaptations (Blomkvist & Holmlid, 2011a). Based on an extensive literature review, Blomkvist and Holmlid have summarized 3 main purposes for using prototypes: *Exploring*, *evaluating* and *communicating* (*ibid*). These three purposes are related to the fidelity but also to the different phases or moments of the design process.

1.3.4 Moment in design process

Depending on which moment in the design process the prototype is created, the format, fidelity, and purpose of the prototype varies accordingly. In the early moments the prototypes tend to consist of low fidelity sketches with the purpose of *exploring* new opportunities, while there might be an increased fidelity and *evaluative* as well as *communicative* intentions in the later stages. The moment in the design process hence influences the appropriate format, fidelity and purpose of a prototype used to span knowledge boundaries between designers or engineers and their various collaborating actors.

1.4 Prototypes as potential Boundary Objects

To sum up, the prototyping literature highlights the ability of prototypes to represent ideas in a tangible way to explore, evaluate and communicate ideas and to perform as boundary spanners or ‘boundary objects’ (figure 2)

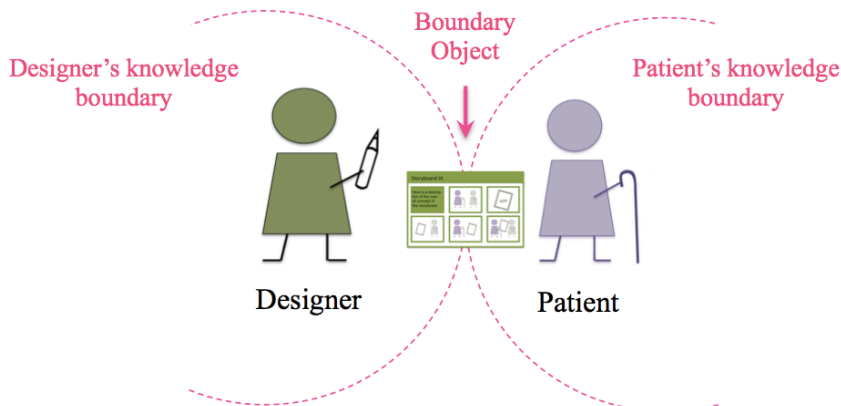


Figure 2: A Boundary object can span knowledge boundaries

(Blomkvist & Holmlid, 2011a; Carlile, 2004; C. Lee, 2005; Rhinow et al., 2012; Star & Griesemer, 1989). The term boundary object was first proposed by Star and Griesemer and later elaborated by Carlile. Star and Griesemer describes boundary objects as being *“objects which are both plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites”* (Star & Griesemer, 1989; 393).

Carlile builds on the concept focus on the *transformative* nature of a boundary object, by highlighting that an effective boundary object at a pragmatic boundary *“facilitates a process where individuals can jointly transform their knowledge”* (Carlile 2002, 452). According to Carlile, transformation of knowledge is the most important aspect in novel and cross-disciplinary situations which characterises innovation activities in general and Open innovation activities in particular: *“Objects, models and maps [such as prototypes] are the only category of boundary object that directly supports transforming knowledge”* (Carlile 2002, 452). Transforming knowledge means that an object can be altered, negotiated and changed by the people involved at each side of the boundary, which is exactly what happens when prototypes are used to engage with different actors.

It is important to note, that introducing boundary objects is not about creating consensus across the knowledge borders, the common identity of the prototype is merely a way to coordinate design efforts (Star 2010; Star and Griesemer 1989; Kimble, Grenier, and Goglio-Primard 2010; Bechky 2011). If the prototype is successful, both designer and ‘actor’ will have transformed their knowledge through negotiations – which gives way for new knowledge, and a new version of the prototype developed based on mutual alignment (Carlile 2004). And coordination efforts are of the utmost importance when engaging a range of actors in Open Innovation activities. The person in charge of these coordination activities is often also the person designing the prototype to have a common identity between designer and other actor, while staging and navigating the interaction. Even though the navigator is regarded a central actor, the actor roles are not pre-determined and set in stone. As the case will illustrate, the navigator changes during the case, and is not the only actor who influences the turn of events.

While Star and Griesemer (1998) as well as Carlile (2004) focus on boundary negotiations at a single location, the nature Open Innovation activities calls for multiple interactions at different locations, as I will illustrate in the case. Interaction and transformation of knowledge happens in diverse locations such as hospitals, creative design rooms and business corridors, which are quite distinct in terms of material arrangement and atmosphere. However, the prototyping literature does not fully reflect these processes of transformation nor discuss the navigation of prototypes to interest actors at diverse locations. To help tackling these concerns, I will introduce the theoretical framework of Actor Network Theory (ANT) as a means of understanding and analysing how navigators obtain support (interessement in ANT terms)

of actors. Hereafter I argue for introducing the new ‘concept’ Prototyping Spaces to serve as a sensitising device to shed light on the role of prototypes in navigational efforts of Participatory Design.

1.5 Theoretical Framework – the art of interessement

Discussions of the significance of interesting actors in innovation processes to support and adapt new designs are reflected in the STS literature. Recently design scholars have recognised the analytical strengths of ANT and have engaged in linking ANT to Participatory Design (Andersen et al., 2015; Lindström & Ståhl, 2015; Schoffelen et al., 2015). Within ANT, ‘interessement’ is one of the means for network-building and gaining support for a new product, service or system: *“Innovation is the art of interesting an increasing number of allies who will make you stronger and stronger”* (Akrich et al., 2002, 205). The allies to be involved play a significant role in adapting the final solution: *“the fate of innovation, its content but also its chances of success, rest entirely on the choice of the representatives or spokespersons who will interact, negotiate to give shape to the project and to transform it until a market is built”* (Akrich et al. 2002, 217). Involving internal and external actors from the entire value chain during the design process ensures that once the product is prepared for market launch, the most crucial negotiations have already taken place, and the product is ready to conquer the market.

A way to analyse how different actors become allies, who support a new solution, is by turning to the concept of “translation”. Translation is a process where networks are formed by negotiating and delimiting the identity and role of actors and the possibility of interaction and manoeuvring (Callon, 1986). The process of translation is said to consist of 4 moments of which ‘interessement’ is the second one: *problematization* (a problem/agenda is set forth), *interessement* (actors become interested in supporting), *enrolment* (the roles of the actors are defined and inter-linked) and *mobilization* (the actors actively work for the agenda set forward) (ibid). Interessement, is particularly relevant in this article, as this is the moment where the initial navigational moves of engaging internal and external actors in the design process is put to the test using different ‘Interessement Devices’ (Callon, 1986; Sage et al., 2011). These devices (which could involve the use of mock-ups and prototypes at different locations) are challenged and transformed at the moments of interessement, being the encounters and negotiations between the navigator (designer, researcher or engineer) and the actor the designer wishes to interest (patient, doctor, company manager etc.). *“Innovation continuously transforms itself according to the trials to which it is submitted i.e. the ‘interessements’ tried out. Each new equilibrium finds itself materialized in the form of a prototype which concretely tests the feasibility of the imagined compromise”* (Akrich et al., 2002, 213). In the electronics company this interessement is often attempted through negotiations and dialogue triggered by prototypes. Later in the design process, the focus might likely shift towards not only interesting but also enrolling and mobilizing the actors to actively work for testing and implementation of the final solution. However, it is not the

scope of the article to look into all the moments of translation, as this article is mainly dealing with the initial stages of the design process where *interessement* is most prevalent. With the concept of *Interessement Devices* in mind, let us now consider the ‘space’ configured by the navigator, and in which *interessement*, negotiation, and transformation of knowledge take place.

1.6 The space-metaphor

Within the ANT-tradition network building activities is at the centre of attention. However, the concept of a network seems to be increasingly diluted, particularly because of its difficulties in handling temporality, which is crucial in design (Clausen & Gunn, 2015; Lindström & Ståhl, 2015). To illustrate the dynamics of political and/or socio-material aspects related to design and innovation processes, authors from the STS community have suggested a range of metaphors for networks (Clausen & Gunn, 2015). Examples of such metaphors are socio-technical spaces, arenas of development and Design: Labs (Binder & Brandt, 2008; Clausen & Yoshinaka, 2007a, 2007b; Jørgensen & Sørensen, 1999).

Clausen and Gunn also introduces the notion of Temporary Spaces of innovation and argue that “*Innovation increasingly involves movements through and across a number of temporary spaces that include actors outside R&D departments, including from other areas of corporate life, various companies in a supply chain, design aspects of everyday life and use practices*” (Clausen & Gunn, 2015, 75). With their concept of temporary spaces Clausen and Gunn analyses how user-knowledge is translated in a collaborative setting resembling what is at stake in Open Innovation activities. Therefore, the concept of temporary spaces of innovation will serve a source of inspiration when analysing the design activities of the electronics company.

1.7 Prototyping Spaces

In line with Clausen and Gunn, I argue that the different instances of interaction between a navigator/facilitator and an actor from the value chain can be seen as temporary ‘spaces’ for design and innovation. Drawing from the benefits of linking ANT and Participatory Design, while focusing on prototypes as means to negotiate knowledge and meaning across boundaries and interest actors, I suggest terming such spaces *prototyping spaces (PS)*. I argue that ‘Prototyping Spaces’ might be used as a sensitising device to point to how designers, researchers, and engineers might navigate a prototype to play a role in the *interessement* (and potential enrolment) of various actors at several moments throughout a Participatory Design process.

I suggest that interesting actors in the design process is a 3-step activity with a transformative outcome: Firstly the *navigator* stages the prototyping space to work as an *interessement* device. Second, a *facilitator* attempts to interest an actor using a *pro-*

prototype as a potential boundary object and part of the interessement device. And third, if the interessement device works, the actors are becoming interested and a transformation of knowledge takes place (see Figure 3).

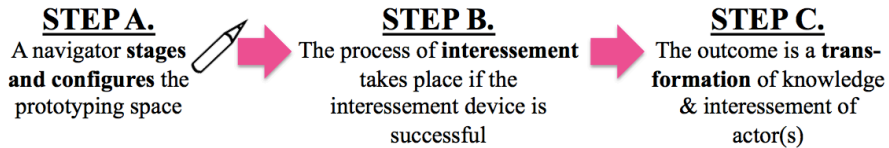


Figure 3: The 3 step process of interesting actors in design processes

Staging a prototyping space entails navigating the following 5 configuring elements identified based on the literature review on prototypes by Blomkvist and Holmlid (2011) and my analysis: 1) A *facilitator* who facilitates the interaction in the prototyping space, 2) the internal or external *actors* to become interested, 3) a *purpose* (exploring, evaluating or communicating), 4) the assembly of materials and meanings that constitutes the *location*, and 5) an appropriate prototype *format* (Figure 4). All 5 elements are inevitably also related to the overall product development activity, how it is organised and at which moment in the process this activity takes place.

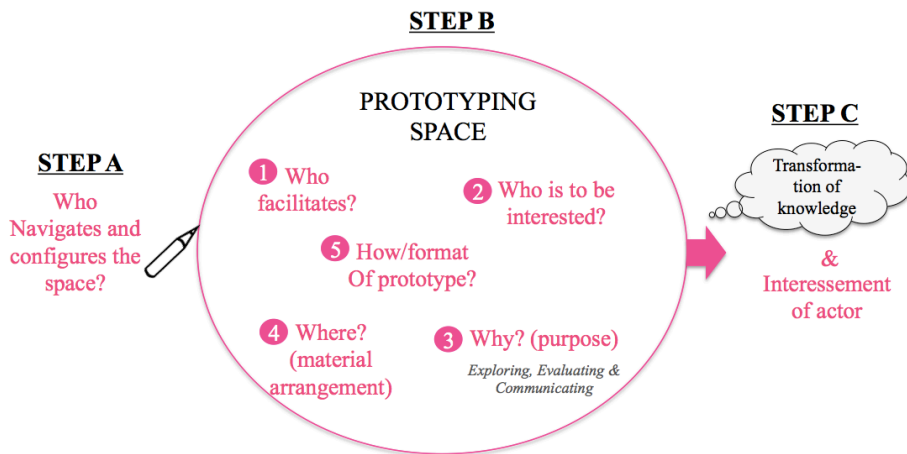


Figure 4: The configuration of a prototyping space including the questions a navigator must ask himself in the process

2 METHODOLOGY

The article is based on ethnographic research focusing on how end-users and other actors from the value chain become involved and engaged in designing new products, services and systems in an Open Innovation context in a large, private company. The empirical knowledge obtained through the ethnographic research allows me to analyse and communicate what happens in a genuine on-going design project. The research was conducted in the period of 2014-2015 and revolves around the development of a new app to be used while stroke patients are admitted to the hospitals' neurological wards. The empirical material has partly been collected through traditional ethnographic field study techniques (Van Maanen, 2011), including observations and qualitative interviews (DiCicco-Bloom & Crabtree, 2006) and the research is both exploratory and multi-sited (Marcus, 1995, 1999). I have pursued an open approach tracing the involvement of internal and external actors in the design process across different sites including the company headquarters and 3 different hospitals in Denmark. Participant observation (DeWalt et al., 1998), allowed me to become an integrated part of the project team partaking in some of the design activities. Taking active part through participant observation has proved very beneficial, giving me access to insights, and allowing me to not only observe but who spark changes in situations. Also, being part of the project has enabled me to conduct numerous informal interviews with the members of the project team about the specific project and the design practices of the company in general. Hence, some of the elements in the case being unfolded in this article, I have experienced first hand, while some activities were described to me second hand. Furthermore, I have done a literature review and participated in 3 workshops arranged by the company to get an understanding of their overall approach and vision.

2.1 Developing an app for recovering stroke patients

The design team I was part of was engaged in the process of designing and delivering products and services related to stroke-patients. Being developers and manufacturers of hospital equipment, the process from idea to market is often long because the products need to be tested and validated to comply with national and international legislation. Previously the company had to keep their new products secret right up until product launch to protect their ideas from being copied by competitors. During this period especially the internal interestment and navigation within the company across business units and cross-disciplinary project teams, was very important. Having committed to an Open Innovation mind-set, however, means that they are opening up for collaboration with both customers and new potential partners. Consequently, an even wider variety of actors are to be interested already from the beginning of the design process. To ensure interestment from buyers as well as users, participatory design methods are used to interest external partners such as hospital directors, doctors, nurses, therapists, patients, and relatives. This openness makes it more complicated and time consuming to develop new products and systems. However, the reward for doing this extra work, lies in the robustness and appropriateness of the new solutions, which already at product launch has a lot of

allies supporting them. Usually the company's design department 'owns' the product design process, which entails a focus on re-designing existing solutions already assigned to a specific Business Unit. However, the stroke app-project was initiated, formulated, and 'owned' by the research department, which according to company traditions, makes it particularly explorative and open for new opportunities. This explorative nature increases the innovation potential but also decreases the chances of the project making it to product launch, as radical ideas means more uncertainty and higher risks.

2.1.1 *Establishing the project team*

A team of scientists from the research department engaged in a dialogue with hospital neurologists about their work related to stroke patients, and eventually came up with an idea for a new app to support stroke-patients as well as hospital staff in providing accurate diagnostics and a speedy recovery. The scientists usually rely on quantitative studies such as randomised control trials (RCT) to validate the impact of new solutions, and the job of the scientist is often focused on validating rather than on exploring and designing. Thus, the scientists are not used to engage in design-oriented conversations and interactions, so the project manager hired a designer from the company's own design department to assist them gaining qualitative insights about the range of actors who might be in contact with the potentially new stroke app. The designer was unlike the scientists not specialised in neurological conditions and the practices of hospital neurology wards. Hence, the designer had a lot to learn in a short period of time. She learned from the scientists presenting their findings in power-point format at a number of meetings, did desk research and conducted field visits to a couple of hospitals to get a sense of the nature of the work, the staff, and the life of the patients at apoplexy (stroke) wards. When the designer had gained some initial knowledge about stroke and practices at the ward, an internal, creative workshop was held in one of the 'creative rooms' at the company's premises. The scientist leading the project team invited the project team as well as employees not assigned to this particular project, to get a wide range of expertise and innovative ideas on the table. The outcome of the workshop included eight ideas of how the company might create value at the stroke wards. These ideas were represented by 8 hand-drawn storyboards, each having approx. 6 'scenes' on them, illustrating how each idea would influence hospital staff, patients and relatives.

In the following I will present 3 different episodes that can be viewed upon and analysed using the concept of Prototyping Spaces.

2.1.2 *Prototyping Space 1 (PS1) - Interesting external actors at the hospital*

The designer brought the 8 storyboards to a couple of hospitals to get feedback and new ideas from patients, relatives, doctors, nurses, occupational therapists etc. to help her guide company in a prosperous direction. The storyboards were designed to allow different actors (patients, relatives and hospital staff) to evaluate and comment on them by actually having written their possible future tasks into the storylines.

Together the designer and the scientists prepared a thorough interview guide to ensure, that each space was staged in a similar manner. Equipped with the interview guide and 8 storyboards, each printed on an A4-size paper, the designer visited 3 hospitals in 2 different countries.

PS1: The designer is half-running through the hospital, trying to keep up with the extremely busy doctor she is following and observing during her visit at the hospital. The designer has the storyboards tucked tightly under her arm, ready to pull them out if a chance to talk to either the doctor or one of the patients recovering from a stroke suddenly arises. The doctor is busy doing his rounds and following up on consultations with patients adding new information to the patient records. However, in between making an entry into one of the patient records, he has a minute to look at the storyboards. The designer quickly pulls the storyboards, and starts explaining the different ideas. Sensing the impatience radiating from the doctor, the designer quickly addresses the key scene of each storyboard instead of going through all 6 'scenes', while noting down the doctor's comments. At IPM one of the patients awakes from his nap and has agreed to talk to the designer. The designer positions herself on the patient's bedside, and soon the storyboards are scattered all over the duvet. The patient tries to comprehend and separate the different ideas from each other and is struggling to maintain focus as the designer goes through the scenes of all 8 storyboard. The patient has difficulties understanding the ideas, and instead pulls a stack of pictures of his house and his family from his bedside table, and enthusiastically starts showing them to the designer. The designer is experienced, and hence does not let this 'setback' prevent her from learning new insights from the patient. Instead she starts asking general questions related to the different aspects of the 8 ideas, and the patient responds by engaging in a dialogue about his current situation, which is what he can manage to relate to at this moment.

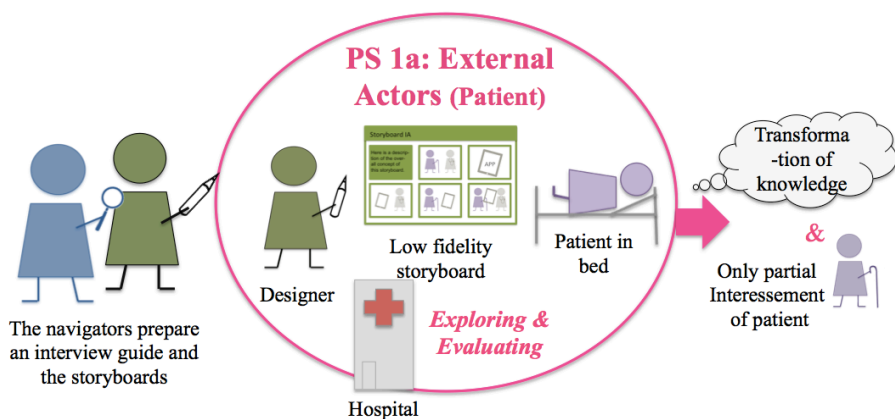


Figure 5: PS1a: Interesting patients at the hospital using storyboards

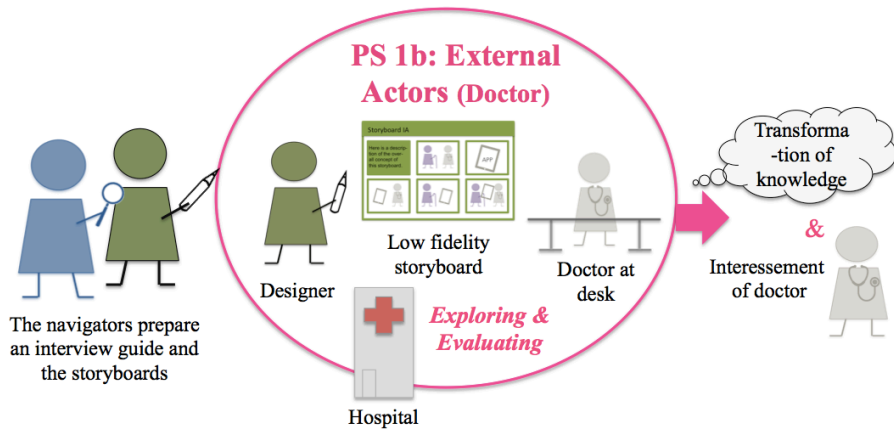


Figure 6: PS1b: Interesting the doctor at the hospital using storyboards

Let us look at how these 2 particular prototyping spaces were configured (see Figure 5 and 6). The designer can be seen as having the role of both the *navigator* and the *facilitator* of space 1a and 1b. Together, she and the researcher, had developed interview guide and storyboards with the *purpose* of *exploring* new opportunities and *evaluating* the current ideas of the project team. The storyboard-format supported by the interview guide worked as boundary objects in the communication between the *actors to be interested* (the patient and the doctor) at the *physical location* and material arrangement of the patient's bedside as well as the doctor's office. Facilitating the interactions at the hospitals also meant that the designer got a sense of the practices of the staff and patients in their natural environment. Not everything worked as intended, e.g. the A4-sized papers were constantly on the verge of falling down from the patient's bed, and were in general quite difficult to handle. However, the drawings, illustrating patients, relatives and hospital staff, made the ideas relatable for both patient and doctor, as they could see their roles included in the storylines.

The designer was trained to learn and in that process transform her knowledge based on actor-inputs. She holds knowledge about how the ideas are meant to work in practice, and the doctor and patient holds knowledge about their daily lives, current situation as well as their dreams and aspirations. The designer managed to gain insights and feedback from the doctor, but the many scenes in each storyboard made it time consuming to go through all 8 ideas together with the busy doctor. The patient, however, was recovering from a recent, severe stroke, and was not quite able to follow all the ideas and separate the information from each other. Instead he gave up, and started showing pictures from his everyday life outside the hospital. The

prototyping space was not entirely successful as an interestment device, as the designer was neither able to transform the knowledge of the patient nor to interest him in the design process. Therefore, the designer had to adapt to the situation and started asking about general aspects of the ideas related to his current life and situation.

2.1.3 Prototyping Space 2 (PS2) - Communicating within the project team

After conducting field visits and engaging in many interactions similar to what was illustrated in PS1a and PS1b, trying to interest around 20 doctors, nurses, patients and relatives, the designer had obtained a lot of information and insights that she wanted to share with her colleagues in the project team. Hence, she staged the next prototyping space by inviting the project team to participate in a workshop with the aim of sharing her knowledge and deciding in which direction to designing a solution. She prepared an agenda for the meeting and booked a creative meeting room at the company headquarters to set an imaginative scene for the workshop (Figure 7).

PS2: Pieces of paper with pictures and quotes generated from the interactions with actors at the hospital, together with printouts of the original storyboards lies scattered on the table in one of the creative rooms. Also the walls are used to hang up A3-sized versions of the storyboards and pictures taken at the hospitals. Present are most members of the project team which counts three scientists, two designers (focusing on user-research), one UX (user experience) designer and a back-end designer (programmer). They collectively go through the quotes and comments from patients, relatives, doctors, nurses, physiotherapists etc. while looking at each storyboard. "This patient don't like to have visitors at all – that sounds really odd?!" One of the researches exclaim. Well, the thing is, the designer says, that he is going back to jail after he is emitted from the hospital – so maybe he doesn't have the nicest of friends. "Then what if we make a separate UI for the patient where he can control who gets to visit – is that possible?" "Well... Yes, that shouldn't be a problem" the back-end designer concludes. The project manager asks the designer to write findings and agreements into the URS (user requirements specification) and FRS (functional requirements specification) to update them so the project team has the latest version available electronically at all times.

This time the designer was the sole navigator of the space, and invited a group of people into the prototyping space to communicate her findings, and to facilitate a shared exploration and evaluation of the findings. Text, pictures, and illustrations represented the physical location of the hospitals as well as the life, thoughts, dreams, and wishes of the people whom the designer engaged during her visits. The combination of text and pictures spoke to the mind-sets of scientists as well as designers, while the designer was there to contextualise and elaborate when questions arose. The scientists and other designers asked questions and came up with new ideas in a process having an exploring, evaluating and communicating nature. The

designer had transformed the insights gathered from prototyping space 1 (PS1) into quotes and pictures relatable for the actors of PS2 (Figure 7).

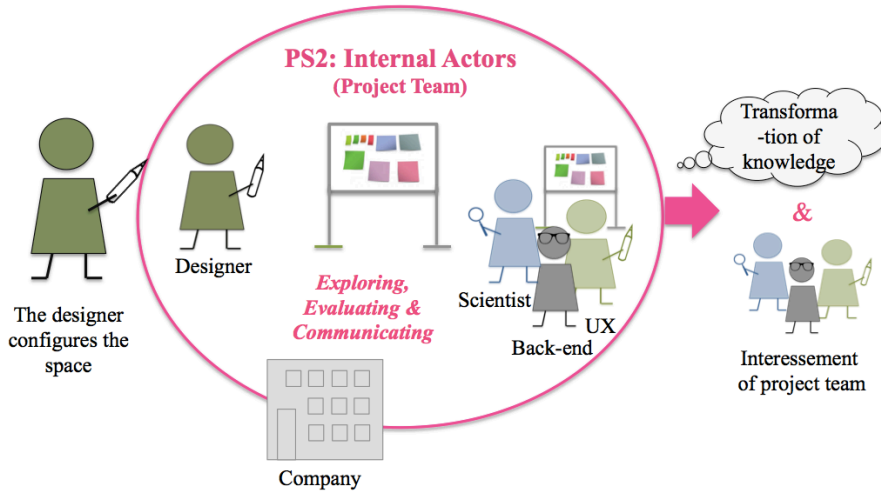


Figure 7: PS2: The prototyping space where the designer communicates to the team

The designers in the project team easily engaged with the quotes and pictures and transformed their knowledge based on the collected insights. The scientists had more difficulties relating to the quotes and hence needed the designer to explain her knowledge and represent the external actors from PS1. Based on the inputs of the external actors, a combination of some of the 8 concepts was selected for further development. After the workshop, the designer used the URS and FRS to communicate the insights formally to the project team as required by proper project management procedure within the company.

2.1.4 Developing, communicating and evaluating the final concept

After the workshop, the designers sat together and brainstormed to come up with a final idea to present to the rest of the project team. Different ideas were put forward, and eventually the designers agreed upon a final concept. At this point the UX designer brought her special competences to the table, which is designing user-interfaces and visualising concepts. She designed a poster, illustrating the final concept from the perspectives of patient, relatives, and hospital staff respectively. This prototyping space was quite similar to PS2. The aim was to share the final concept and get feedback from the team to ensure agreement with the concept to be developed into a semi-functional app for testing and promotion. The large poster was attached to one of the walls in a creative room at the company premises, and was presented for the rest of the project team, who eventually agreed on the final concept. After this session the UX designer started the task of designing the actual user-

interface. Based on the URS and the FRS she worked closely together with the back-end designer, doing the actual programming of a nearly functional prototype of the app.

2.1.5 Prototyping Space 3 (PS3) - The leading scientist presents the concept to the internal actors

Once the nearly functional app was finished, the leading scientist, who was also the project leader, took over the role as navigator. The next phase of the design process entailed *communicating* and ‘selling’ the concept to internal as well as external decision-makers (see Figure 8).

PS3: Equipped with the new, almost fully functional, prototype the leading scientist approaches the manager in his office at the executive corridors of the company. He pulls the iPad from his bag and starts launching the app, which has a UI (user interface) that looks very polished and finished. The scientist takes the initiative and says: “Now we have a version ready of the app I told you about. Let’s login here. Now you see this screen, and here you can even take a picture and attach it to the patient overview. Let’s try that! Smile to the camera!” Click! “Then we click here, and the picture is attached.” The manager is quite excited about the ease of use and the polished appearance and eventually approves of the concept.

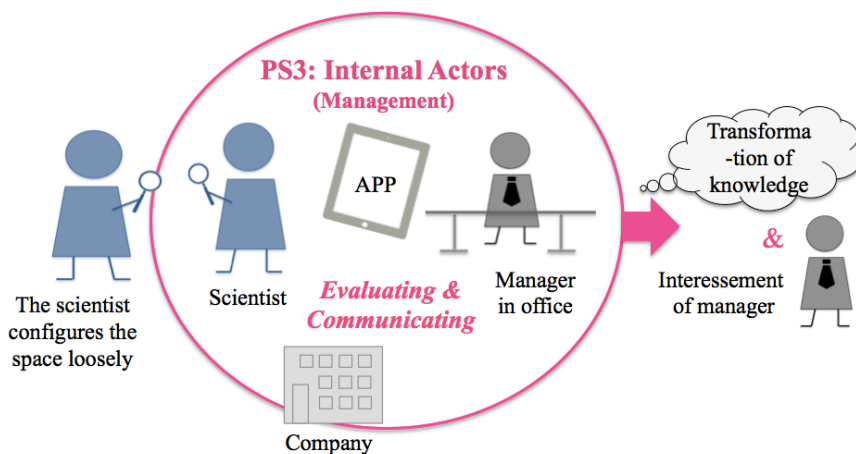


Figure 8: Prototyping space where the scientist demonstrate app to manager

Unlike the staging of the previous Prototyping Spaces, the interaction with the manager was staged very loosely by the scientist and did not involve e.g. an interview guide or an agenda. The scientist attended the meeting and used a polished and finished-looking prototype of the app to communicate the idea and concept to his manager. This nearly fully functional prototype was powerful because it illustrated

that a solution was already available at an early stage in the process. With the help of the designer, the UX designer and the back-end designer translated the URS and FRS into an app representing the work and the research done until now. The manager appreciated the nice-looking app and approved of the concept because he could relate to the prototype and see how it would bring value to stroke patients, their relatives and the hospital staff. The interessement device worked as the manager's engagement with the prototype transformed his knowledge to see the value of this new app, and interested him in being part of the further development. However, the app was not yet ready for market launch, as one final interessement was yet to happen.

2.1.6 *Realising the Concept*

As with all the solutions developed by the research department, the ownership of the app needed to be transferred from the research department to one of the business units (BUs) of the company, to become a sellable product. This meant, that one of the BU managers needed to approve the concept. As it turned out, none of the BUs of the company wanted to take ownership of the app, as they were unable to see, how the app could add value to their current products and thus sold as part of a larger 'package' of products and services. The project manager did not manage to interest the BUs let alone enrol them, which meant, that the app was never commercialised. Doctors, nurses, occupational therapists, physiotherapists, patients, relatives, app developers, designers, scientists and managers was interested in the design process of the stroke app, but because BUs from the company was not, the project was eventually terminated. It was not all in vein though. As it turned out, some of the elements from the app were instead incorporated in another app-platform that emerged as a spin-off from the first project. This meant that all the knowledge gathered in the initial design process was taken forward by the same project team, but in a new direction. The new app fitted the work of one of the BUs very well, which meant that this BU was already interested from the very beginning of the project, and also indicated their desire to be enrolled and mobilized. Now the work began interesting the neurologists at different hospitals, as they were to be the main users of the new concept and also the main group of actors to interest in the design process to follow.

2.2 Discussion

Drawing from ANT, boundary object literature, prototyping literature, and the case study, I have proposed the concept of Prototyping Spaces to illustrate the complexity of the interactions illustrated in the case.

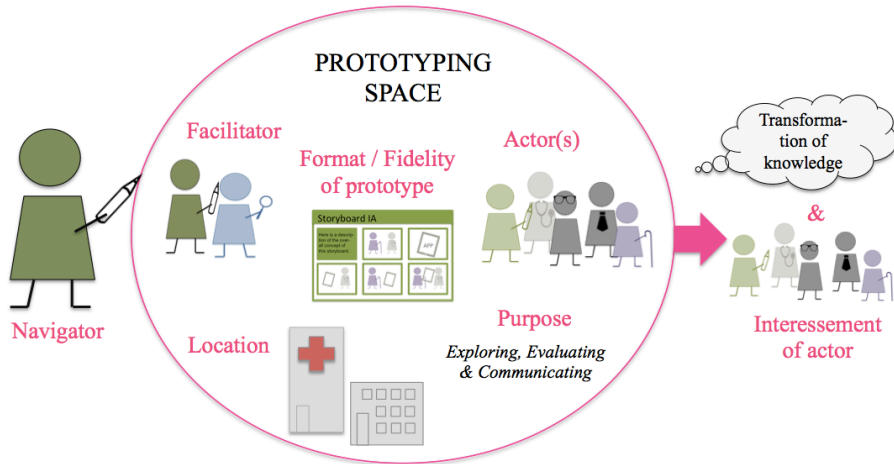


Figure 9: Navigation, configuration and outcome of prototyping spaces

This complexity can be described and discussed focusing on how the spaces are staged and navigated, which configuring elements are influencing the interessement of an actor, and how knowledge is transformed (see figure 9).

2.2.1 The role of the navigator

The case indicates that the role of the *navigator* was to stage the prototyping space to work as an interessement device (Akrich et al., 2002; Callon, 1986; Sage et al., 2011). In PS1 the designer and scientists developed scenarios and interview guide to use in the effort of interesting patients and doctors at the hospital. In PS2 the designer made an agenda and prepared quotes and pictures for the workshop at the company premises, and in PS3 the focus of the scientist-navigator was communicating the idea to the manager and the BU leaders at company headquarters, hoping for their approval. In every space, the role of the navigator was to stage the space, according to who was to be interested and the purpose of the interaction. The role of being a navigator is taken up by different actors throughout the design process, which leads us to understand the diversity involved in the work related to staging interessement devices. Now let us analyse the configuring elements of the PSs staged by the navigator.

2.2.2 The 5 configuring elements constituting a prototyping space to interest various actors

The prototyping literature indicates 5 configuring elements constituting the prototyping space. Each element influences the interessement of actors in different ways depending on the moment in the design process.

1. *Facilitation* is one of the cornerstones of design (Blomkvist & Holmlid, 2011a; Brandt, 2007; Y. Lee, 2008; Vaajakallio & Mattelmäki, 2007), and each space is facilitated by a *facilitator*. In PS1 and PS2 the designer was involved in facilitation as well as in staging and navigation of the space. The designer conducted field trips to the hospitals interesting patients and doctors to explore and evaluate ideas, and made sure that the insights gained were communicated to the rest of the project team. Later in the process, when focus shifted towards communicating and ‘selling’ the concept to managers and BUs, the lead scientist took over this role. This points towards the insight, that the facilitator is not always the same but might change according to the space.
2. The various *actors* to be interested in the design process reflected the Open Innovation culture of the company. Most scholars within user-centred, user-driven, participatory and co-design, focus only on involving clients and/or end-users in participatory processes (Blomkvist & Holmlid, 2011b; Brandt, 2007; Buur & Matthews, 2008; Sanders & Stappers, 2008). However, in this case we see how external actors (patients, doctors, nurses and relatives) *as well as* internal actors (the project team, management and BU leaders) was invited into the prototyping spaces as part of the interessement. It is interesting to note, that the internal stakeholders who was not attempted interested until the end of the project, the BU leaders, were eventually the ones leading to project closure. Also the mental state of the patients recovering from a stroke, challenged the format of the rather long and cumbersome storyboards. Hence, it is crucial to stage the space thinking about the types and capabilities of the actors to be interested.
3. The *purpose* of each prototype could be explained by the labelling of Blomkvist & Holmlid (2011a), which was to explore, evaluate, and communicate. In the early stages, the purpose was mainly on exploring and a little on evaluating, as the feedback and thoughts of the patients and doctors where to set the direction of the project. However, as time progressed the focus shifted towards evaluating and communicating the almost finished prototype to the managers and BU leaders. Hence, the purpose of the prototype, like the fidelity, changes according to moment in the design process.
4. Though only little information is available in the literature on how *location* and *material arrangements* influences design situations, there is no doubt that the location played a role in the interessement activities. Binder and Brandt have used the spatial metaphor of Design: Labs to illustrate the exploratory nature of the design research conducted in workshop settings at the location in which the new design is to be used (Binder & Brandt, 2008). Also other research points towards valuable

benefits of being in the real context as opposed to a constructed workshop setting (Iacucci & Kuutti, 2002; Vaajakallio & Mattelmäki, 2007).

In the first prototyping space the long storyboards proved too big and cumbersome to use. They were neither designed to be used at the patient's duvet-covered bedside, nor to be taken along hurrying after the doctor on the go. The almost finished nice-looking prototype of the app fitted well with the management corridors at the company estate and reflected that the project team had managed to design a 'product' from all their efforts. Hence, from this we gain an understanding that the location influences the success of the interessement device.

5. The *fidelity* and the *format* of the prototype were designed according to the actor to be interested, and the moment in the design process. In the beginning of the design process quick and low cost prototypes such as the storyboard drawings were made to support the initial exploration and evaluation of ideas, while later in the process a nearly finished prototype of the app helped communicate the progress and efforts of the design team to the manager. The fidelity and the format of the prototypes hence changed according to the moment in the design process, which is very much in line with the work of the current prototyping literature (Blomkvist & Holmlid, 2011a; Brandt, 2007; Houde & Hill, 1997; Rhinow et al., 2013; Sanders & William, 2003; Walker et al., 2002). There are also indications, that the fidelity should be adjusted according to which actor is to be involved. The project manager might not have been so easily convinced if the scientist had only shown him a rough sketch of the solution.

2.2.3 Transformation of knowledge through successful boundary objects

The boundary object literature suggests, that in order for the prototype to prove a successful part of the interessement device, the knowledge of both facilitator and actor is transformed during a process of negotiation and adaptation of the prototype (Carlile, 2002, 2004). In PS1 the designer staged and facilitated the prototyping space in a way that she managed to transform the knowledge of the doctor by engaging him in a dialogue and interest him in the design process. At the same time, the designer transformed her own knowledge about the ideas on the storyboards by getting feedback and insights from patient and doctor respectively. The pictures and quotations used in PS2, was a result of the transformation of the designer's knowledge gathered in PS1 embodied and represented by one or more material objects. The case thus supports the boundary object theory and indicates the transformative nature of prototypes.

2.3 Conclusion

In this article, I have proposed the concept of Prototyping Spaces and through an exploratory case study in an industrial setting used Prototyping Spaces to shed new light on the role of prototypes. The case has illustrated a navigational role of staging prototyping spaces to work as Interessement Devices (step A), 5 configuring elements that is influenced by the moment in the design process (step B), and the transformational outcome of this interactions in the space (step C) (see figure 4):

Step A. The role of the *navigator* can be taken on by different actors during the design process and the emerging nature of the spaces leads us to understand the diversity involved in the work related to staging interessement devices.

Step B. The 5 configuring elements:

- 1 The *facilitator* is not always the same but changes according to the different spaces.
- 2 It is important to stage the space thinking about the types and capabilities of the *actors* to be interested.
- 3 The *purpose* of the prototype like the fidelity changes according to moment in the design process.
- 4 The *location* in terms of *material arrangements and atmosphere* influences the success of the interessement device.
- 5 The *fidelity* and the *format* of the prototypes hence change according to the moment in the design process and should be adjusted according to which actor is to be involved.

Step C. By drawing on boundary object theory Prototyping Spaces points to the *transformative* nature of prototypes.

Configuring Elements	Early (PS1)	Middle (PS2)	Late (PS3)
Purpose	Exploring	Evaluating	Communicating
Format	Storyboard	URS & FRS	App
Fidelity	Low fidelity	Low fidelity	High fidelity
Actor(s)	Patients and doctors (external)	Project Team (Internal)	Manager and BU leaders (Internal)
Navigator(s)	Designer & Scientist	Designer	Scientist
Facilitator(s)	Designer	Designer	Scientist
Overall intent	Interessement	Interessement	Interessement and enrolment

Table 1: Overview of configuring elements according to moment in design process

In Table 1, we see that the temporality of the prototyping spaces makes it evident, that the navigator needs to change and reconfigure the space during the design process. The 3 spaces are quite different in configuration because they are designed to specific actors and for different purposes at different moments in the design process.

Thus to sum up: Prototyping Spaces is both a sensitising device and a realm of understanding, which sheds new light on the emergent role of prototypes to interest different actors in design processes in a transformative manner.

Conceptual contribution:

Actor-Network Theory highlights that there are certain configuring elements in a Prototyping Space, which the navigator needs to consider and navigate if the PS is to work as an effective Intersement Device at different moments in the design process. The prototyping literature provides some knowledge concerning the configuring elements of the Prototyping Space. And the case illustrates that if a prototype works as Boundary Objects in a Prototyping Space then it is one of the central configuring elements to support the intersement of new actors in the design process. Hence Boundary Object theory contributes to appreciate and analyse prototypes in an emerging/changing context, which highlights the transformative nature of prototypes as Boundary Objects.

Practical contribution:

Designers, engineers, and researchers are offered a new concept of Prototyping Spaces in their efforts to stage, navigate and facilitate transformative interactions with different actors at various moments in the design process. This applies not only in Open Innovation contexts but in other types of design and innovation settings as well.

REFERENCES

- Akrich, M., Callon, M., Latour, B., & Monaghan, A. (2002). the Key To Success in Innovation Part i: the Art of Interesement. *International Journal of Innovation Management*, 6(2), 207–225.
- Andersen, L. B., Danholt, P., Halskov, K., Hansen, N. B., & Lauritsen, P. (2015). Participation as a matter of concern in participatory design. *CoDesign*, (October), 1–12.
- Binder, T., & Brandt, E. (2008). The Design:Lab as platform in participatory design research. *CoDesign*, 4(2), 115–129.
- Björgvinsson, E. B., Ehn, P., & Hillgren, P.-A. (2012). Design Things and Design Thinking: Contemporary Participatory Design Challenges. *Design Issues*, 28(3), 101–116.
- Blomkvist, J., & Holmlid, S. (2011a). Existing Prototyping Perspectives: Considerations for Service Design. In *Nordic Design Research Conference* (pp. 1–10). Helsinki.
- Blomkvist, J., & Holmlid, S. (2011b). Service designers on including stakeholders in service prototyping. *Proceedings of the 6th International Conference on Inclusive Design – Include 2011*.
- Brandt, E. (2007). How Tangible Mock-Ups Support Design Collaboration. *Knowledge, Technology & Policy*, 20(3), 179–192.
- Brown, T., & Wyatt, J. (2010). Design Thinking for Social Innovation. *Stanford Social Innovation Review*, 8(1), 30–35.
- Buur, J., & Matthews, B. (2008). Participatory Innovation. *International Journal of Innovation Management*, 12(3), 255–273.
- Callon, M. (1986). Some Elements Of A Sociology Of Translation: Domestication Of The Scallops And The Fishermen Of St Brieuc Bay. In J. Law (Ed.), *Power, action and belief: a new sociology of knowledge?* (pp. 196–223). London: Routledge.
- Carlile, P. R. (2002). A Pragmatic View of Knowledge and Boundaries : Boundary Objects in New Product Development. *Organization Science*, 13(July 2014), 442–455.
- Carlile, P. R. (2004). Transferring, Translating, and Transforming: An Integrative Framework for Managing Knowledge Across Boundaries. *Organization Science*, 15(5), 555–568.
- Chesbrough, H. W. (2006). *Open Innovation: The New Imperative for Creating And Profiting from Technology* (1st ed.). Boston, Massachusetts: Harvard Business

School Press.

- Clausen, C., & Gunn, W. (2015). From the Social Shaping of Technology to the Staging of Temporary Spaces of Innovation – A Case of Participatory Innovation. *Science & Technology Studies*, 28(1), 73–94.
- Clausen, C., & Yoshinaka, Y. (2007a). Sociotechnical Spaces - Guiding Politics, Staging Design. In B. C. Stahl (Ed.), *Issues and Trends in Technology and Human Interaction* (pp. 213–229). Idea Group Inc (IGI).
- Clausen, C., & Yoshinaka, Y. (2007b). Staging socio-technical spaces: translating across boundaries in design. *Journal of Design Research*, 6(1), 61–78.
- Coughlan, P., Suri, J. F., & Canales, K. (2007). Prototypes as (Design) Tools for Behavioral and Organizational Change: A Design-Based Approach to Help Organizations Change Work Behaviors. *The Journal of Applied Behavioral Science*, 43(1), 122–134.
- DeWalt, K. M., DeWalt R., B., & Wayland, C. B. (1998). Participant Observation. *Handbook of Methods in Cultural Anthropology*.
- DiCicco-Bloom, B., & Crabtree, B. F. (2006). The qualitative research interview. *Medical Education*, 40(4), 314–321.
- Enkel, E., Gassmann, O., & Chesbrough, H. W. (2009). Open R&D and open innovation: exploring the phenomenon. *R&D Management*, 39(4), 311–316.
- Gregory, J. (2003). Scandinavian Approaches to Participatory Design. *International Journal of Engaging Education*, 19(1), 62–74.
- Henderson, K. (1991). Flexible Sketches and Inflexible Data Bases: Visual Communication, Conscription Devices, and Boundary Objects in Design Engineering. *Science, Technology & Human Values*, 16(4), 448–473.
- Houde, S., & Hill, C. (1997). What do Prototypes Prototype? *Handbook of Human Computer Interaction*, 1–16.
- Iacucci, G., & Kuutti, K. (2002). Everyday life as a stage in creating and performing scenarios for wireless devices. *Personal and Ubiquitous Computing*, 6(4), 299–306.
- Jørgensen, U., & Sørensen, O. H. (1999). Arenas of Development - A Space Populated by Actor-worlds, Artefacts, and Surprises. *Technology Analysis & Strategic Management*, 11(3), 409–429.
- Kensing, F., & Blomberg, J. (1998). Participatory Design: Issues and Concerns. *Computer Supported Cooperative Work (CSCW)*, 7, 167–185.
- Kensing, F., Simonsen, J., & Bødker, K. (1998). Participatory Design at a Radio Station. *Computer Supported Cooperative Work*, 7, 243–271.

- Kimble, C., Grenier, C., & Goglio-Primard, K. (2010). Innovation and knowledge sharing across professional boundaries: Political interplay between boundary objects and brokers. *International Journal of Information Management*, 30(5), 437–444.
- Lee, C. (2005). Between Chaos and Routine: Boundary Negotiating Artifacts in Collaboration. *Ecscw 2005*, (September), 387–406.
- Lee, Y. (2008). Design participation tactics: the challenges and new roles for designers in the co-design process. *CoDesign*, 4(1), 31–50.
- Lindström, K., & Ståhl, Å. (2015). Figurations of spatiality and temporality in participatory design and after – networks, meshworks and patchworking. *CoDesign*, 0882(October), 1–14.
- Marais, S. J., & Shutte, C. S. L. (2009). The Development Of Open Innovation Models To Assist The Innovation Process. In *Innovation In Industrial Engineering, 23rd Annual SAIIRE Conference* (pp. 97–116). Gauteng, South Africa.
- Marcus, G. E. (1995). Ethnography in/of the World System: The Emergence of Multi-Sited Ethnography. *Annual Review of Anthropology*, 24, 95–117.
- Marcus, G. E. (1999). What is at Stake - and is not - in the idea and practice of multi-sited ethnography. *Canberra Anthropology*, 22(2), 6–14.
- Namioka, A., & Schuler, D. (1993). *Participatory Design: Principles and Practices*. (D. Schuler & A. Namioka, Eds.). Taylor & Francis.
- Piller, F., Ihl, C., & Vossen, A. (2011). Customer Co-Creation: Open Innovation with Customers A typology of methods for customer co-creation in the innovation process. In V. Wittke & H. Hanekop (Eds.), *New Forms of Collaborative Innovation and Production on the Internet - An Interdisciplinary Perspective* (pp. 31–63). Göttingen: Universitätsverlag Göttingen.
- Prahalad, C. K., & Ramaswamy, V. (2004a). Co-creating unique value with customers. *Strategy & Leadership*, 32(3), 4–9.
- Prahalad, C. K., & Ramaswamy, V. (2004b). Co-Creation of Value. *The Future of Competition: Co-Creating Unique Value with Customers*.
- Rhinow, H., Köppen, E., & Meinel, C. (2012). Design Prototypes as Boundary Objects in Innovation Processes. *Conference on Design Research Society*, (July), 1–10.
- Rhinow, H., Köppen, E., Moritz, J., Jobst, B., & Meinel, C. (2013). Prototypes for Innovation – Facing the Complexity of Prototyping. *Proceedings of the Cambridge Academic Design Management Conference 2013*, (September), 4–5.

- Sage, D., Dainty, A., & Brookes, N. (2011). How actor-network theories can help in understanding project complexities. *International Journal of Managing Projects in Business*, 4(2), 274–293.
- Sanders, E. B.-N. (2013). Prototyping For The Design Spaces Of The Future. In L. Valentine (Ed.), *Prototype: Design and Craft in the 21st Century* (pp. 1–8). Bloomsbury.
- Sanders, E. B.-N., & Stappers, P. J. (2008). Co-creation and the new landscapes of design. *CoDesign*.
- Sanders, E. B.-N., & William, C. T. (2003). Harnessing People's Creativity: Ideation and Expression Through Visual Communication. *Focus Groups: Supporting Effective Product Development*, 137–148.
- Schoffelen, J., Claes, S., Huybrechts, L., Martens, S., Chua, A., & Moere, A. Vande. (2015). Visualising things. Perspectives on how to make things public through visualisation. *CoDesign*, (October), 1–14.
- Schrage, M. (2006). Cultures of Prototyping. *Bringing Design to Software*, (May), 191–205.
- Star, S. L., & Griesemer, J. R. (1989). Institutional Ecology, 'Translations' and Boundary Objects: Amateurs and Professionals in Berkeley's Museum of Vertebrate Zoology, 1907-39. *Social Studies of Science*, 19(3), 387–420.
- Van Maanen, J. (2011). Ethnography as Work: Some Rules of Engagement. *Journal of Management Studies*, 48(1), 218–234.
- Vinck, D., & Trompette, P. (2009). Revisiting the notion of Boundary Object. *Revue D'anthropologie Des Connaissances*, 3, 1(1), 3–25.
- von Hippel, E. (2005). Democratizing innovation: The evolving phenomenon of user innovation. *Journal Fur Betriebswirtschaft*, 55(1), 63–78.
- Vaajakallio, K., & Mattelmäki, T. (2007). Collaborative Design Exploration: Envisioning Future Practices with Make Tools. *Design Pleasureable Products and Interfaces*, (August), 223–238.
- Walker, M., Takayama, L., & Landay, J. a. (2002). High-Fidelity or Low-Fidelity, Paper or Computer? Choosing Attributes when Testing Web Prototypes. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, 46(5), 661–665.
- Zomerdijs, L. G., & Voss, C. a. (2010). *Service Design for Experience-Centric Services*. *Journal of Service Research* (Vol. 13).



STAGING CO-DESIGN OF ACTOR NETWORKS

Pedersen, Signe

Brodersen, Søsner

Aalborg University, Denmark

Abstract

In this article the authors take up the challenge posed by Latour about mapping controversies and designing things (socio-technical assemblies dealing with matters of concern) instead of designing products. This brings our attention to the role of the designer, since it requires new skills to tackle this challenge. In the article the authors strive to answer the question of how are designers to navigate and stage design interactions and processes with the aim of designing networks (things) involving matters of concern? To deal with this question the authors suggest an approach, which they have named SCOAN (Staging CO-design of Actor-Networks) and can be understood as an elaboration of Participatory Design combined with ANT's considerations of networks, negotiations, controversies and alignment. The authors argue, that a design process can be seen as consisting of a number of temporary spaces for design and innovation, which needs to be carefully staged, and illustrate how using the SCOAN approach helped create a new network aiming at bringing insulin closer to poor diabetes patients in India in a business context.

Keywords: Participatory Design, Actor-Network Theory, Staging, Mapping controversies

1 INTRODUCTION

'Now here is the challenge' Latour (2008) argues and continue 'In its long history, design practice has done a marvelous job of inventing the practical skills for drawing objects, from architectural drawing, mechanic blueprints, scale models, prototyping etc. But what has always been missing from those marvelous drawings (designs in the literal sense) are an impression of the controversies and the many contradicting stakeholders that are born within with these. In other words, you in design as well as we in science and technology studies may insist that objects are always assemblies, "gatherings" in Heidegger's meaning of the word, or things' (p. 12).

In this article the authors take up this challenge, and in doing so, argue that the object of design is a matter of designing networks – or *things* as Latour would call them. Latour's *thing*-concept implies that an object of design is not only a material object, but instead complex socio-technical assemblies of contradictory issues that deals with what he calls 'matters of concern'. As part of the challenge given above, Latour asks the question to designers: *'Where are the visualization tools that allow the contradictory and controversial nature of matters of concern to be represented?' (Latour 2008, p. 13).* In doing so, Latour pinpoints the importance of visualizing all the controversies and negotiations happening in a participatory design project. Our argument for drawing attention to these considerations is twofold. One is highlighting an evolution in the role of the designer, from driving the design process forward using her/his expert knowledge to being a reflective designer navigating between several actors (not only users), objects as well as assemblies of these; and two, is directing attention to the issue of designing networks or *things* instead of objects. The question then become, how are designers to navigate and stage design interactions and processes with the aim of designing networks (*things*) involving matters of concern? Drawing from Participatory Design and using Actor-Network Theory prescriptively, we will focus our attention to answering this question.

1.1 Participatory Design: From design in organizations to design in public and back again

Recent discussions within the Participatory Design community raise several concerns related to the future progression of the scholarly discipline (Bergvall-Kåreborn & Ståhlbrost, 2008; Storni et al., 2015). It is argued that Participatory Design scholars seem to be too focused on methods and tools (Buur & Matthews, 2008), and that the community needs to return to its original focus on change and democracy. Such arguments is for instance found in the recent special issue of CoDesign, where especially the editors (Storni et al., 2015) argue for *designing things together* and *making things public*, as the approach towards returning to the original ideas of democracy in Participatory Design. These arguments indicate a shift in how Participatory Design is practiced, from settings defined and staged by the designers for a specific purpose, using certain design tools to facilitate the interaction, towards a more open design space, where focus is on involving the 'public' in design activities in public

places. We support a democratic design process, but despite this interesting challenge of making things public, these ideas and arguments seem difficult to translate into design projects having fairly restricted problematizations (e.g. Design Briefs provided by project owners), which is often the point of departure in design projects initiated by companies or NGOs with a specific focus. Further, by *making things public*, the role of designer seems to blur, transforming the role of the designer into a sort of facilitator. Our argument is, that the role of designers' in Participatory Design is to create networks, and like Storni et al. (Storni et al., 2012) we argue that *'In this sense you do not design 'A' product or 'A' solution to 'A' problem: as an engineer of the heterogeneous, you rather design actor-networks'* (p. 12). However our disagreement arise when Storni (Storni, 2015) and the rest of the authors in the special issue of CoDesign suggest designing these actor-networks in public. By *'Echoing mapping controversies'* (p. 167), Storni quite literally takes up Latour's challenge and suggests putting emphasis on visualizing differences among the actors while suggesting the role of the designer to be that of a 'map circulator' and 'updater'. Using material objects such as drawings, mock-ups and prototypes in dialogue between different actors and the designer, is at the core of Participatory Design, and we also advocate using boundary objects to translate knowledge and interest actors. However, we oppose to Storni's reduction of the role of the designer to being merely a 'map circulator'. Being merely the facilitator of the dialogue, we argue is not enough when new networks are to be co-designed, since it requires both navigation and staging skills to understand whom and what to invite onto the stage, when, and how. We argue, that there is a need for the designer to be able to stage and navigate on different levels: A number of design interactions with invited actors is to be staged, and so is the entire design process. Thus in order to create new networks, the designer's role becomes much more reflective than seen in traditional Participatory Design as well as in the more recent Participatory Design literature (e.g. Storni et al., 2015). The question then becomes how is the designer to stage and navigate the co-design of new networks when working in a context involving companies or other organizational structures? In such settings the designer should not only co-design together with end-users and other external actors, s(he) also needs to translate the knowledge about these actors into the organization. To deal with this question we suggest an approach, which we have named SCOAN (Staging CO-design of Actor-Networks).

1.2 Staging CO-design of Actor-Networks

The SCOAN approach is to be understood as an elaboration of Participatory Design combined with ANT's considerations of networks, negotiations, controversies and alignment. SCOAN builds on the assumption that a design challenge is to be understood as a challenge of co-designing new networks, and draws on Callon's (1986) ideas of translations for interesting, enrolling and mobilizing actors into the design process. Callon (1990) and Latour (2005) argues that ANT can help scholars describe innovation as a continuous process of building networks by interesting and enrolling both human and non-human actors, to create support for the project in

order to expand and strengthen the network. When designing new networks in a business context, the designer is confronted with a complex set of different perspectives, wishes, and knowledge from a variety of actors, that all somehow comes in touch with the actor-networks, that are designed. Thus, understanding how to involve the various actors from the entire network, which is to constitute the design solution, becomes focal for the designer. To help guide this process the approach draws on the perspectives of *Staging*, since this notion combines the efforts of ANT and Participatory Design, by helping us understand, how an activity is framed in terms of bringing together actors and perspectives in a design process through different material objects and facilitation (Clausen & Yoshinaka, 2007). The concept is inspired by the theatre metaphor: certain actors are invited onto the stage to enact existing frames of understanding, to selectively frame problems, solutions and events, and enact circumstances and conditions using props such as design games or mock-ups in their efforts. Creating reflective conversations and interactions between participants and objects and enacting stories of future use are seen as ‘ways to put the design and arrangement of space, scenery and props, the staging, into play’ (Brandt et al., 2005). Staging also encompasses writing a script and directing the actors so they feel secure and guided throughout the performance. Furthermore, staging relies on the actors’ ability to improvise, as there is no rigorous manuscript provided by the designer. The actors and the props highly influence the plot or story to be performed, and the non-deterministic nature of staging implies that the designer also needs to be able to improvise – and in the unforeseen is where navigational skills comes in.

We argue, that a design process can be seen as consisting of a number of temporary spaces for design and innovation, which needs to be carefully staged. Pedersen (2016) uses the concept of Prototyping Spaces as a sensitising device to look into the configuration of such spaces, and the translation of knowledge from one space to another. SCOAN draws on the concept of Prototyping Spaces to understand how prototypes as boundary objects are an integral part of staging fruitful dialogue between the designer and an actor, and how the designer might navigate a prototype to play a role making actors interested to become enrolled at several moments (spaces) throughout a Participatory Design process.

1.2.1 Moments of Translations

Co-designing new networks means staging and navigating alliance-building between human and non-human actors in the process of translation Callon (1986). Since focus in this article is on the staging of temporary prototyping spaces for interaction with actors, our primary interest lies within the *problematization* and *interessement*, since these are the moments where the initial navigational moves of engaging allies in the design process is attempted using different ‘interessement devices’ (Callon, 1986; Sage et al., 2011). The allies/spokespersons to be interested through different interessement devices, are identified though the navigational decisions of the designer as part of the staging: *‘the fate of innovation, its content but*

also its chances of success, rest entirely on the choice of the representatives or spokespersons who will interact, negotiate to give shape to the project and to transform it until a market is built' (Akrich et al. 2002; 217). If many actors are involved, the final solution has the potential of having a lot of allies, however, this also means, that many controversies may arise in the process of designing the solution. So, what is at stake for the designer might not be for all actors to align with one pre-defined problem or solution, but rather to learn and gain understanding of how various actors relate to e.g. a design brief, and forms the basis for interessement and participation. Next, we illustrate how using the SCOAN approach helped create a new network aiming at bringing insulin closer to poor diabetes patients in India.

2 DESIGNING A HEALTHCARE RELATED PRODUCT SERVICE-SYSTEM IN INDIA

2.1 Initiating the design project and inscribing practices into boundary objects

One of the authors of this article was hired as part of a team of two Danish external design consultants by a large pharmaceutical company to help them design and develop a scalable business model of how to 'bring insulin closer to the poor patients in India'. India is one of the World's biggest diabetes markets, and the company wanted to offer their products to the low-income segment of people living with diabetes. What the pharmaceutical company outlined in a sort of 'design brief' could be termed the problematization of bringing insulin closer to the diabetes patients. The design brief prescribed the involvement of patients with diabetes and diabetes doctors, and furthermore, the pharmaceutical company had identified 5 'values' related to being a diabetes patient, which they wanted the patients' reflections upon. These were: affordability, availability, accessibility, acceptability, bulk size and service. The service aspect was of particular importance since this was one way of testing the problematization of bringing insulin closer to the patients.

Elements of the initial design research was based on previous efforts from a group of Danish business school students who did a study in India and developed an idea to a new business model based on interviews with around 10 pharmacists selling diabetes medicine. They also spoke with so-called 'quacks' who traditionally serve as the people's local doctor/pharmacist. However a quack has no education within medicine, but still he has earned the trust of many locals due to traditions, his availability in the local area and perhaps also through a history and relationship with other family members. The design team pre-planned a large number of meetings with different Indian actors. Not only did they plan to meet with diabetes patients and doctors as inscribed in the design brief, but also with NGO workers, health workers, and even with companies delivering other products closer to their customers for inspiration. Some of the actors were identified beforehand; while others emerged during the travel through roll-the-snowball technique.

Instead of seeing the design challenge as a logistics problem of transporting insulin to rural areas, the design team immediately started to envision the solution to the challenge as what is known as a product service system in design and engineering circles. In an ANT perspective, a product service system is indeed a network (or *thing*) consisting of material objects as well as people and relations. The product (the insulin) was to be brought closer, by providing a service delivered by people (e.g. health workers as entrepreneurs), to other people (the diabetes patients) in rural and slum-areas in India. With that in mind, the designers began staging interactions with the many diverse actors.

Based on the designers' previous experiences, that among others included experiences with working with Indian actors on other projects, that had given them an in-depth insight into the Indian society and culture, the work of the business students, and many hours of desk research, getting inspiration from different initiatives around the world delivering products and services to rural areas, the design team combined the insights into 6 diverse concepts / potential future scenarios, of how the insulin possibly could be brought closer and made more accessible to the poor rural or slum patients.

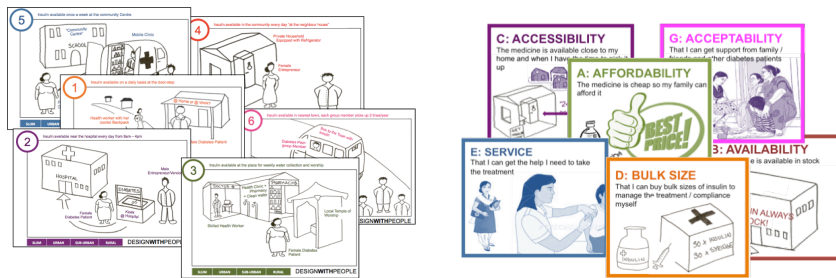


Figure 1: Scenario cards (left) and value cards (right)

The concepts were very diverse and not restrained to already implemented initiatives in order to spark a conversation about different aspects of the service delivery. Knowing the Indian culture and the traditions of being very polite and not making critical judgements, the designers' deliberately included 'controversial' aspects such as women biking in the scenarios to start a discussion about the subject and make the people feel comfortable critiquing the concepts. Hence in one of the concepts a woman in sari biked to a village with insulin, while in another, a male doctor came to deliver the insulin in a mobile clinic. The designers deliberately mixed genders and professions of the people potentially to be involved in the system, together with different places of delivery such as the hospital or the patient's doorstep.

Hand drawings of both scenarios and values were made into cards by gluing on cardboard pieces adding to the materiality and tangibility of the cards (figure 1). The cardboard made the cards not wrinkle and stay put e.g. when interviewing people in

a living room with a cooling fan running on highest level. Choosing the card format was inspired by the designers' knowledge of many poor Indian peoples' tradition of playing cards. Also, the hand drawings in the cards were a deliberate choice, since the low-fidelity nature of the sketches would indicate that the concepts were not finished and hence leave them open for discussions and modifications. Lastly, the actors drawn on the scenario and value cards reflected the Indian culture; e.g. women were dressed in saris, in order to ensure the actor would relate to the actors on the cards and thus de-scribe the practices intended in the cards. Thus, prior to the participatory interaction with the actors, the designers had a lot of considerations to how to stage and configure the Prototyping Spaces e.g. with cards to hopefully work as boundary objects by inscribing the cultural traditions of the actors to become interested into these. Equipped with scenario cards and value cards, the designers were ready to engage with a range of different people in India to gain insights into the lives and aspirations of the people that were going to be included in the new network.

2.2 Staging Prototypes Spaces for interacting with actors in India

During the 14 days the designers spend in India they managed to talk to around 20 different people being diabetes patients, doctors, entrepreneurs, NGO workers, pharmacists etc. with the aim of engaging in dialogue about how a new solution should be designed and whether the problematization was valid. Hence the purpose of each staged space was to explore the lives and thoughts of the different actors related to diabetes diagnostics and treatment while at the same time evaluating the problematization and the different elements of the scenario concepts. In the following the different moments of interaction between designers and actors during the project activities in India is illustrated as temporary prototyping spaces. These spaces are analysed using Prototyping Spaces as a sensitising device focusing on staging in terms of space configuration, navigation and facilitation in each space and it's ability to work as intersement device to interest the actors in the creation of the new network (Pedersen, 2016).

2.2.1 Talking to a diabetes doctor

On the first day in India, the designers met with a male medical doctor specialising in diabetes diagnostics and treatment at his office in New Delhi. This meeting was arranged beforehand, as one of the designers knew the doctor, and his passion for rethinking diabetes treatment, from previous engagements. The meeting began with a general discussion about the effects of insulin and the organisation of the Indian healthcare system at country, region, city and village level. Subsequently, the designers brought forward the scenario cards, which opened up for a discussion about current initiatives. Pointing to one of the scenarios illustrating women biking he exclaimed: *'Women don't bike! That is just the way it is'*. The scenario card illustrating a mobile clinic inspired the doctor to tell the designers about previous similar experiences with mobile clinics in the slum areas. He quickly added that it would be

a nice idea for the current mobile clinics to also begin selling insulin and thereby relatively quickly bring the insulin closer to the patients' homes.

The problematization of 'bringing insulin closer to the diabetes patients', was quickly accepted by the doctor who became interested and suggested ideas based on the scenario cards. Being in his own clinic, the doctor felt comfortable answering questions and looking at the scenario cards, which might have influenced his willingness to become interested. The cards succeeded in serving as boundary objects, as both designers and doctor gained new knowledge in a transformative process of mutual learning. Even though the scenario cards were not designed specifically for interaction with doctors, he was nevertheless able to relate to and interpret them. Further, the Prototyping Space worked as an intersement device, which not only proved fruitful in terms of getting feedback on the scenario cards but also later on in the process when the designers needed a translator – more on that later.

This engagement with a doctor can be illustrated with inspiration from the concept of Prototyping Spaces to analyse the role of the designers, the configuring elements of the space, and the outcome of the engagement (figure 2).

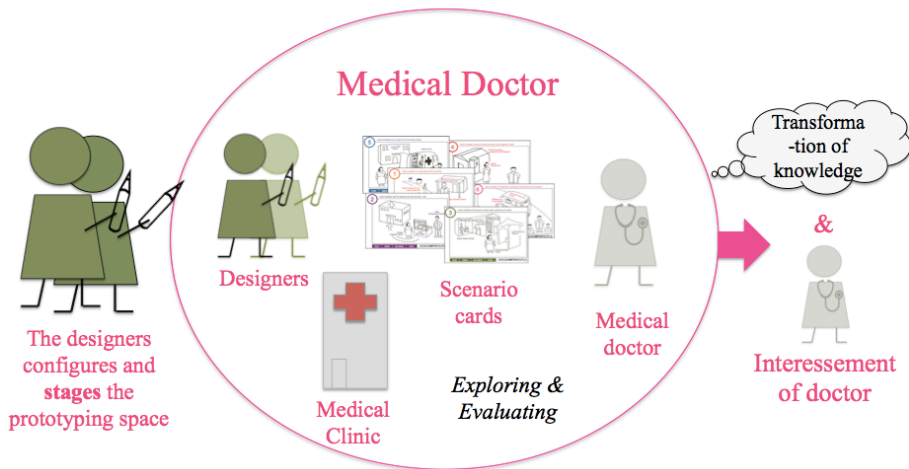


Figure 2: Illustration of the first Prototyping Space – dialogue with a diabetes doctor in his office

2.2.2 Meeting a health NGO

The next interaction in India was a meeting with a NGO working with health related issues. The designers had made arrangements with the NGO prior to going to India, based on an internet search identifying this NGO as a frontrunner in working with diabetes patients. This interaction was staged to learn from their experiences and get their perspectives on a future solution based on the scenario cards (see Figure 3).

The 2 designers were in the backseat of a taxi in a business area far away from the Delhi slum trying to locate the new high-rise building where the NGO was situated. Finally they reached the right destination and went inside the fancy air conditioned building to talk to a NGO project manager who worked with different projects related to providing medicine in poor areas. The project manager enthusiastically looked at the 6 scenarios of how to bring insulin closer to the patient, and started sharing her experience with related projects and interventions while commenting on the ideas. ‘Women do bike! It seems progressive’, she said... ‘But maybe she should also go together with a man for safety’.

The scenario cards were meant to work as boundary objects, but also as provotypes (Boer & Donovan, 2012). Women biking in India are not a common sight (which also indicated by the doctor in in the first Prototyping Space) and also the NGO project manager commented on this issue and began explaining about the customs and traditions in India. From this space the designers learned, that in some areas of the country it is not appropriate for women to be biking – and especially not alone. So if the insulin was to be delivered to the patients’ doorstep, then a woman *and* her husband might go together in pairs to deliver the insulin and to give injections.

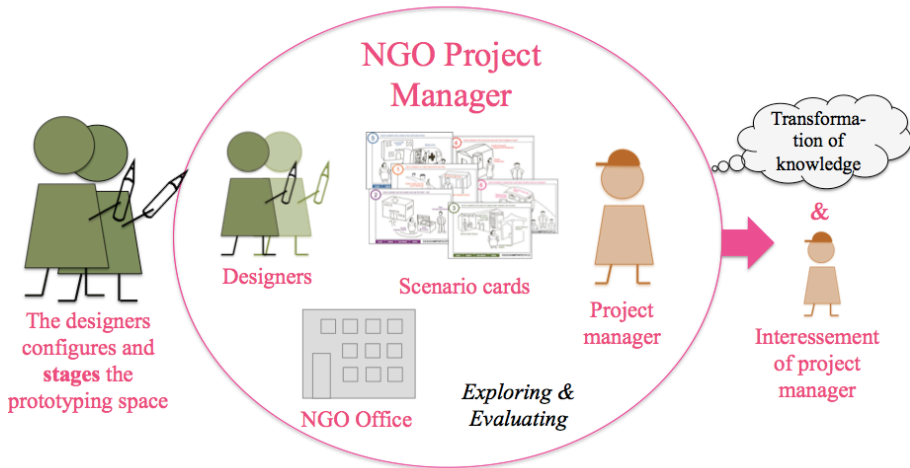


Figure 3: Illustration of the second Prototyping Space: dialogue with a NGO manager

Like in first Prototyping Space with the medical doctor, the project manager was in the comfort of her own office, and the scenario cards worked as a boundary object for the dialogue between designers and NGO manager, since she was able to relate to the intentions in scenario cards and even put forward suggestions to alternative concepts. The designers managed to interest her in the problematization, and she also ended up setting the designers in contact with a local NGO, which enabled the designers to get in contact with patients diagnosed and receiving treatment for dia-

betes. This could be seen as a sign of willingness to be enrolled as well. The configuration of the Prototyping Space meant, that the designers managed to get access to their primary user group, the patients, who might otherwise be difficult to get in contact with.

2.2.3 Engaging an interpreter and engaging with local patients in the slum

The local NGO had a lot of contacts to smaller local NGOs working in specific areas in the Delhi slum, where the designers were eager to go and talk to diabetes patients. Hence through ‘rolling the snowball’ the designers got in contact with a smaller NGO who set up meetings with 4 different patients, selected based on requirements from the designers, of gender equality, and the willingness of the patients to invite the designers into their homes and discuss their disease.

To get into in-depth dialogue with the diabetes patients, the designers realized, that they needed to invite an interpreter to the ‘stage’ (see figure 4). During the meeting with the medical doctor (in the first space), the designers were put in contact with a medical student who kindly offered to be their interpreter for the day. They took him up on his offer, and before going into the slum area the designers and the interpreter met to discuss how the interactions were to take place. The interpreter was introduced to scenarios and value cards and he was told that the aim was to engage in dialogue with the patients about the content of the different cards. He then translated the English writing on the cards into Hindi to ensure also the literate patients were able to read the text. Then they drove towards the slum area to meet the patients.

The taxi parked at the edge of the slum area where the roads were too narrow for it to go through. So the designers and their interpreter continued on foot towards the office of the local NGO. Here they met up with a NGO worker who led them to a tiny household where they climbed the stairs to a small, scarcely furnished bedroom on the 2nd floor. The whole family gathered around the designers, the interpreter, and the patient, to look at the strange visitors and waited excited for what was going to happen. A fan cooled the room with swiping motions. The designers and interpreter presented themselves while taking out the different cards. Firstly the patient was told by the interpreter to rank the different value cards and tell why she had prioritised the way she did. The patient explained her thoughts while physically arranging the cards in order. The service card came up on top because she did not like to use a needle to give herself her own injections. During the conversation, she opened one of her closets and picked up her current medicine and the device to measure blood sugar and showed it to the designers. Afterwards, she was introduced to the scenarios explained in turn by the interpreter. ‘I really like this’ she says pointing to the scenario where a woman delivers the insulin and gives the patient an injection at the doorstep, ‘...and I would pay a little extra for the service instead of going all the way to the hospital’ the patient says without hesitation. She explained that if she does not have to go to the hospital she will save the money for transportation, and her son will not have to take a day off from work to go with her.

Then she was asked to prioritise the scenarios and once she had shared all of her thoughts, aspirations and worries the designers started packing up their cards. Now the patient had a chance to ask the medical-student interpreter some personal questions about her health, which he answered with great delicacy and care. That way the patient also got something back from participating in the dialogue besides from being able to influence the new solution. After conducting 4 interactions with different diabetes patients, the designers and interpreter went back to their taxi and left the slum area.

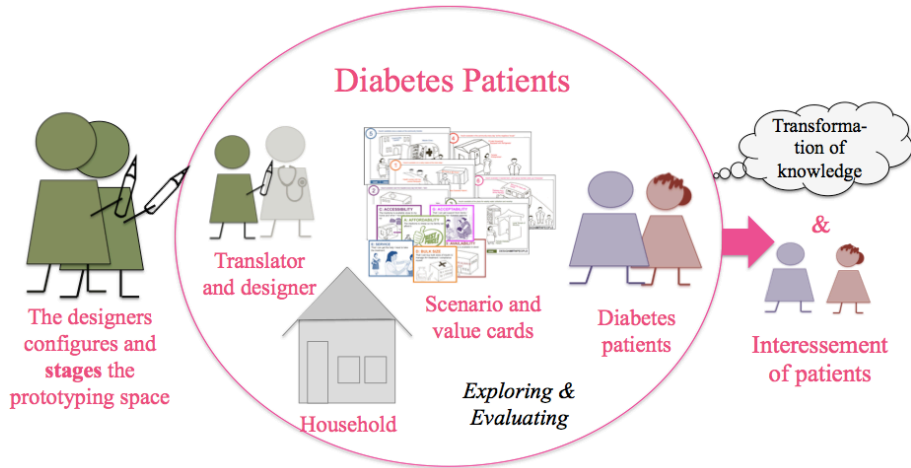


Figure 4: Illustration of the Prototyping Spaces with poor diabetes patients

This was the first time the scenario cards were actually used to engage with the main actor which they were designed for. Also this was the first time the value cards were brought into play, as these were meant to inspire a dialogue with the diabetes patients. Even with the fan cooling the living room the cards remained stable due to the added cardboard, and it was easy for the patients to navigate. Being in the comfort of her own home made the patient feel safe, and it allowed her to pick up her things and show them to the designers. She immediately identified herself with the diabetes patients in the drawings because they were wearing saris and looked like Indian women.

The designers and the translator managed to stage a space in which the patient became interested, as she responded and elaborated in detail on her thoughts about what was represented both in the value cards and the scenario cards. The comments from the patient were of particular interest for the designers and hence they were very eager that the patient got interested and also wanted to be enrolled in the design process later, since a successful solution should be suited to the existing or envisioned practices of the patients.

2.2.4 Meeting a successful product-service company

Next day the designers visited an entrepreneurial company who has had great success delivering a product-service-system, which consisted of eye tests and glasses to poor people in rural areas. This meeting was arranged from Denmark based on an internet search of inspirational initiatives of delivering different types of services to the rural areas of India. The aim of staging this interaction was to learn valuable insights on how to set up a system for delivering a product to the households of the users (see Figure 5).

The designers entered the headquarters of the company and were guided through the area equipped to conduct eye tests before entering the director's office. The director told them, that he was not to answer any of their questions before they both had an eye test done. The designers willingly participated to acknowledge the expertise of the company. After the eye test, the designers started interviewing the director focusing on the company's experiences in designing and implementing the product-service-system. As part of the interview the designers also introduced the scenario cards and asked for the director's insights and comments on these. The director skimmed through all the scenario cards at once, and then provided more general comments like: 'Build upon the existing supply chains and make sure that it is linked to the demand side'.

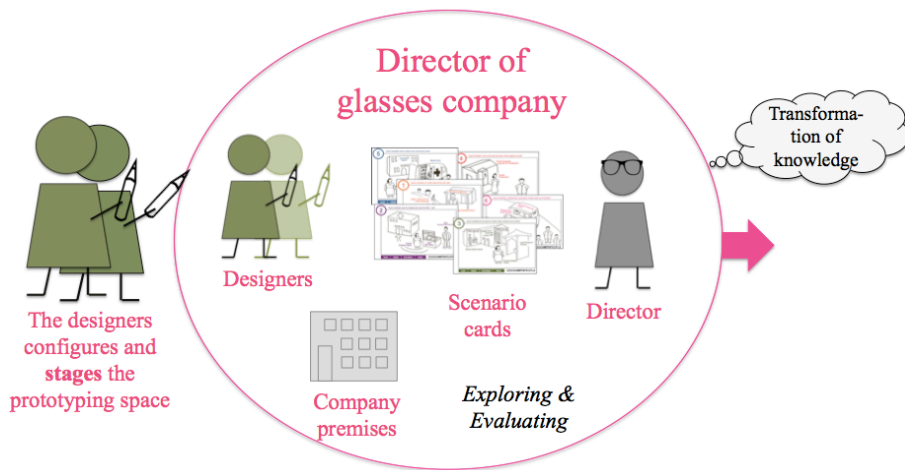


Figure 5: Illustration of the Prototyping Space engaging in dialogue with a glasses-company

In this case the director was not interested in the problematization suggested by the designers. However, the main purpose of this interaction was to learn from his experiences with a very different business model and network-solution. The fact that the director only quickly glimpsed through the scenario cards indicates that the cards did not work as boundary objects. Nevertheless, the designers learned a lot of new

insights that would help them design a suitable insulin delivery system for poor Indian diabetes patients, while the director got a chance to promote his business.

2.2.5 *Developing the final concept*

Once the designers returned back to Denmark they started the process of analysing and processing all the knowledge and insights they collected during the trip to India. To gain an overview of the information, an affinity diagram was produced with all the statements from the actors forming different themes, which were to be considered in the final solution. Some of the themes were very straightforward, as accessibility, services etc. were the themes of the value cards. But also themes such as 'entrepreneur profile', 'incentive structures', 'quacks', 'storage' and 'awareness' emerged. Not only actor quotes were used in the affinity diagram, but also other background information from official reports and from the project conducted by the business school students were included. The designers used different colours for indicating whether a patient or a professional had made a particular statement, as they weighted the voices of the patients higher than the ones of the professionals. Not because they doubted the motives or sincerity of the professionals, but in this case they did not have to rely on professionals for representing the patients, as the patients were directly involved and could speak for themselves. In general, insights provided by professionals had a more holistic and system-oriented nature, while insights provided by patients were more particular and specific. Hence the statements supplemented each other in drawing up the big picture of a new solution consisting of a network of doctors, health workers, quacks, entrepreneurs, patients, insulin, refrigerators, bikes etc.

The final concept was synthesized through brainstorming techniques taking into account the actor inputs, and eventually being a combination of the elements from the scenario-cards and new ideas that received the most positive feedback from patients as well as professionals.

Mainly for communication reasons, but also for testing the final solution, the designers constructed 3 different personas based on often expressed and interesting traits of the participating patients. The personas were used to represent the actual people involved during the visit in India so the company would gain an understanding of their customers. But the designers also used the personas to qualify the final product-service-system solution. For instance, the designers would ask: 'How would this persona use the network making up the new solution?' and hence adjust the idea or concept accordingly to comply with the traits represented by that persona. The final hand over / presentation of the solution to the company included these 3 types of patients with diabetes which the company could get to know and relate to, and hence also 3 different ways of using the final network. This turned out to be a very persuasive way to represent the empirical material / the findings from India as well as the final solution as the company's contact person immediately liked the idea and wanted to set up a pilot project asap. However, in order to persuade her colleagues

This was mainly due to logistic reasons, as quite a few actors was identified during the process, and because the designers wanted to visit the homes of each patient, to be able to observe and learn as much as possible about them. However, in other projects it would potentially be a goal in itself to stage the spaces with more actors, negotiating their worldviews and matters of concern amongst themselves.

As such it can be argued that by visualizing how knowledge from one Prototyping Space is transformed into the next and how all the knowledge is reflected in the final network, is our attempt to visualise and represent matters of concern, as argued by Latour (Latour, 2008).

3.2 Contributions of SCOAN


The case illustrates how the designer is to stage and navigate the Prototyping Spaces as well as the design process to enable knowledge transformation and translation of the knowledge created in each space into a final solution – a network. Hence the designer faces a new role. One of being a reflective designer navigating between several actors, objects as well as assemblies of these, and that of designing networks (*things*) involving matters of concern. Staging is done on different levels, as both the Prototyping Spaces as well as the entire design process are to be staged. Navigating between these levels require a process of identifying interesting actors beforehand and seeking new opportunities along the way using e.g. roll-the-snowball technique to identify new actors to invite onto the stage.

The SCOAN approach addresses this new role of the designer and is our suggestion to an elaboration of Participatory Design combined with ANT's considerations of network-formation and negotiations when working in a business context. By suggesting the SCOAN approach we attempt to bridge what some Participatory Design scholars term PDa (Storni et al., 2015) with the constraints and boundaries set when co-designing in a specific organizational setting. In proposing the SCOAN approach we add to the existing discussions within Participatory Design and Co-design, by introducing a network perspective inspired by ANT, which allows us to understand a design process as a number of differently configured prototyping spaces and a solution as an actor-network.

REFERENCES

- Akrich, M., Callon, M., Latour, B., & Monaghan, A. (2002). the Key To Success in Innovation Part ii: the Art of Choosing Good Spokespersons. *International Journal of Innovation Management*, 6(2), 207–225.
- Bergvall-Kåreborn, B., & Ståhlbrost, A. (2008). Participatory Design - One step back or two steps forward? In *Proceedings Participatory Design Conference* (pp. 102–111). Indiana University.
- Boer, L., & Donovan, J. (2012). Provotypes for participatory innovation. *Proceedings of the Designing Interactive Systems Conference on - DIS '12*, 388.
- Brandt, E., Johansson, M., & Messeter, J. (2005). Design Lab - Re-thinking what and how to design. In T. Binder & M. Hellström (Eds.), *Design Spaces*. Finland: IT Press.
- Buur, J., & Matthews, B. (2008). Participatory Innovation. *International Journal of Innovation Management*, 12(3), 255–273.
- Callon, M. (1986). Some Elements Of A Sociology Of Translation: Domestication Of The Scallops And The Fishermen Of St Brieuc Bay. In J. Law (Ed.), *Power, action and belief: a new sociology of knowledge?* (pp. 196–223). London: Routledge.
- Callon, M. (1990). Techno-Economic Networks and Irreversibility. In *The Sociological Review* (Vol. 38, pp. 132–161).
- Clausen, C., & Yoshinaka, Y. (2007). Staging socio-technical spaces: translating across boundaries in design. *Journal of Design Research*, 6(1), 61–78.
- Latour, B. (2005). Reassembling the Social - An Introduction to Actor-Network-Theory. *Reassembling the Social - An Introduction to Actor-Network-Theory, by Bruno Latour, Pp. 316. Foreword by Bruno Latour. Oxford University Press, Sep 2005*.
- Latour, B. (2008). A Cautious Prometheus? A Few Steps Toward a Philosophy of Design (with Special Attention to Peter Sloterdijk). *Design History Society*, 2.
- Pedersen, S. (2016). 'Staging Prototyping Spaces' – Navigating boundary objects to interest actors in design processes. Copenhagen.
- Sage, D., Dainty, A., & Brookes, N. (2011). How actor-network theories can help in understanding project complexities. *International Journal of Managing Projects in Business*, 4(2), 274–293.
- Star, S. L. (2010). This is Not a Boundary Object: Reflections on the Origin of a Concept. *Science, Technology & Human Values*, 35(5), 601–617.

- Storni, C. (2015). Notes on ANT for designers: ontological, methodological and epistemological turn in collaborative design. *CoDesign*, 11(3-4), 166–178.
- Storni, C., Binder, T., Linde, P., & Stuedahl, D. (2015). Designing things together: intersections of co-design and actor–network theory. *CoDesign*, 11(3-4), 149–151.
- Storni, C., Binder, T., & Stuedahl, D. (2012). Exploring ANT in PD : reflections and implications for theory and practice Workshop at Participatory Design Conference 2012 Exploring ANT in PD : reflections and implications for theory and practice Workshop at Participatory Design Conference 2012.



This PhD dissertation has the format of a travel logbook inviting the reader to learn about my experiences and navigational moves during the exploratory journey being my PhD project. Drawing on ANT and Participatory Design I investigate how knowledge is translated between designers and diverse actors in the process of designing products, services, and systems in a healthcare setting, and use this research for proposing operationalized strategies for navigation in participatory design projects.

- Signe Pedersen